SCIENTIFIC AMERICAN

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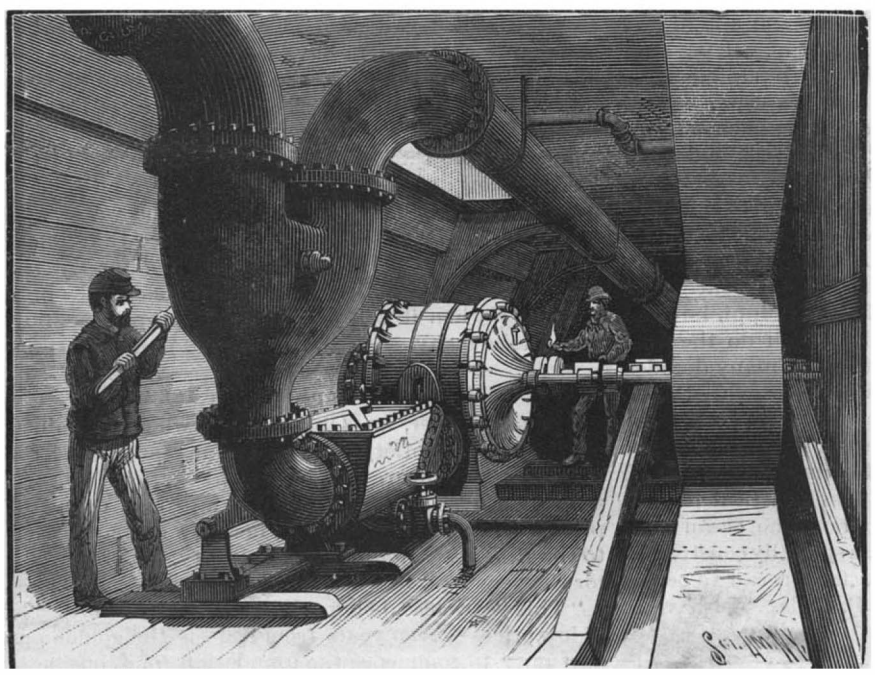
THE IMPROVEMENT OF NEW YORK HARBOR.

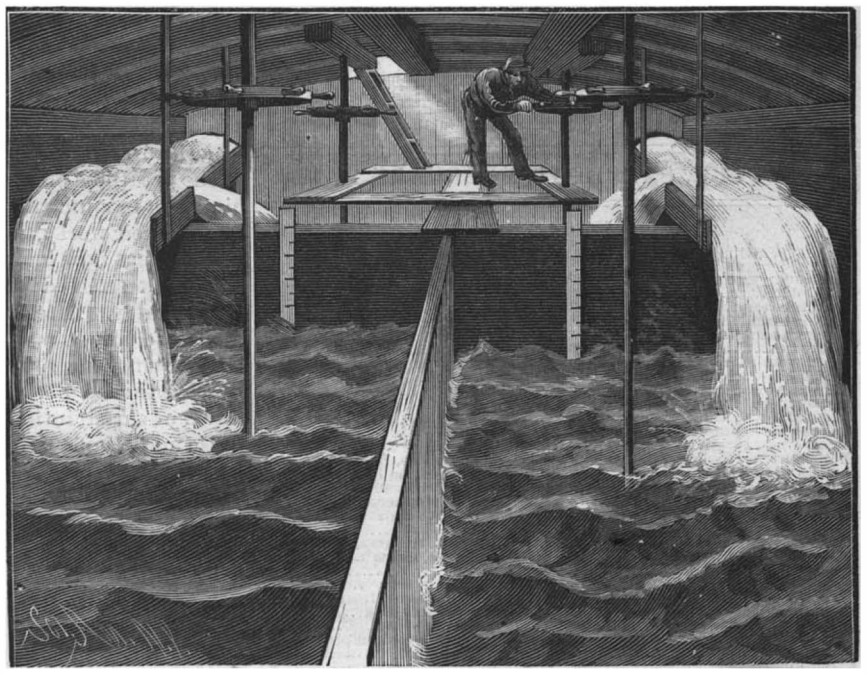
One of the most important operations ever conducted by the United States government, from a commercial point of view, is now in process of execution. We allude to the improvement of the channels leading up to New York City from the ocean. In his recent message to the Board of Aldermen, Mayor Hewitt alludes to this work briefly, emphasizing its great importance to the residents of this city. With the increased length and depth of ocean steamers, it has become very evident during the last few years that something must be done, unless commerce is to be diverted from New York, or, at least, its expansion modified by the restricted depths and widths of the channels. While the question of depth affects the construction of the vessels directly, the narrowness of the channels has rendered necessary quick turning, so that the long type of vessels now in greatest favor for ocean navigation have found great difficulty in getting in and out of the harbor. They have been obliged to arrange their periods of starting by the tide, and very frequently are forced to wait outside of the bar until high water, if they reach it at any other than that period. It has been obvious for many years that some improvement was required, and little prescience was required to see that the necessity for such improvement was increasing in importance.

In 1884, an appropriation of $200,000 was made by Congress under the River and Harbor bill, to be devoted to "the improvement of Gedney's channel, New York harbor." In order to work intelligently

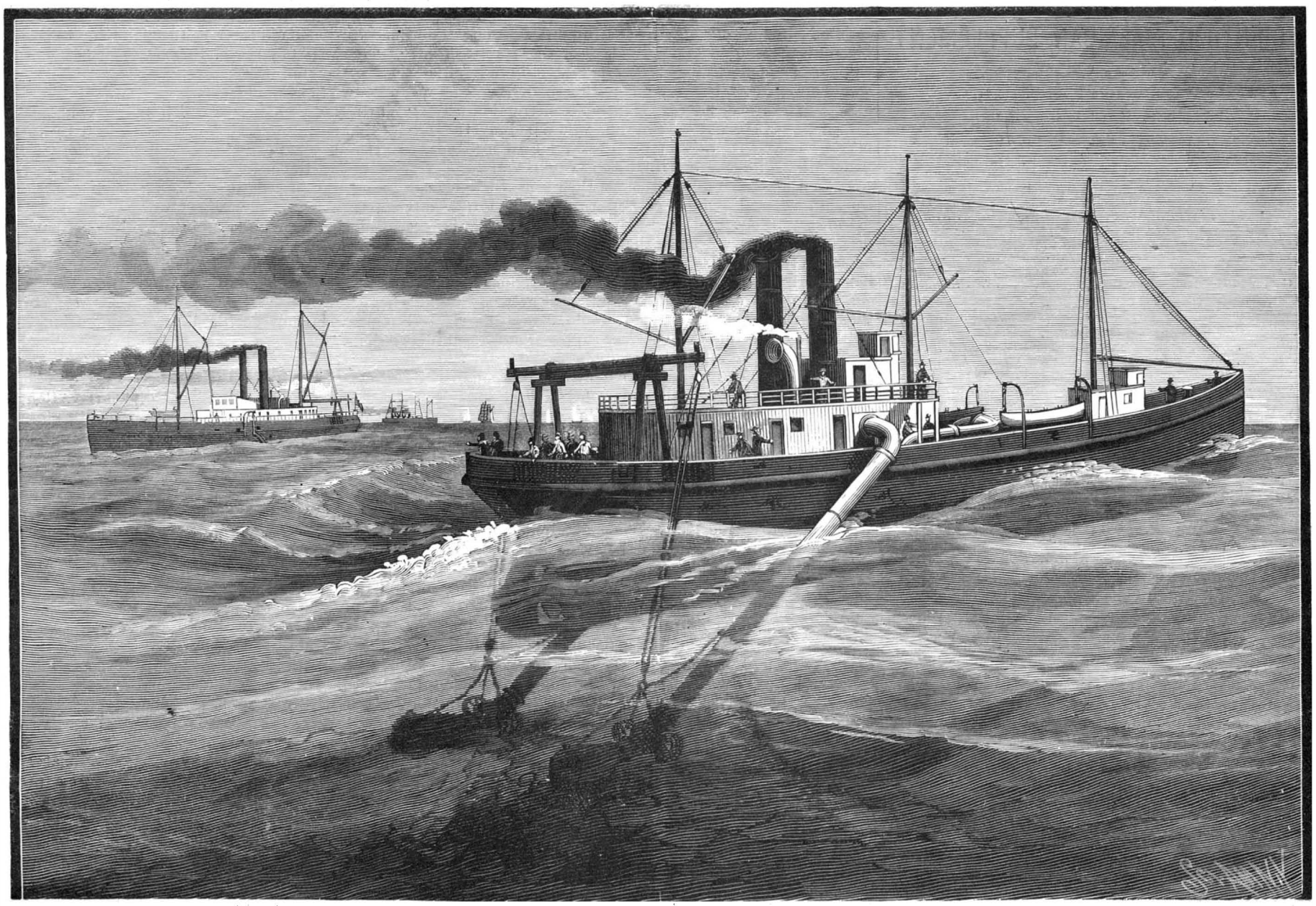
(*Continued on page* 84.)



CENTRIFUGAL PUMPS AND CONNECTIONS.



THE TANKS AND DISTRIBUTING SYSTEM IN THE HOLD OF THE DREDGING VESSEL.



DREDGING VESSEL AT WORK DEEPENING THE CHANNEL IN NEW YORK HARBOR.

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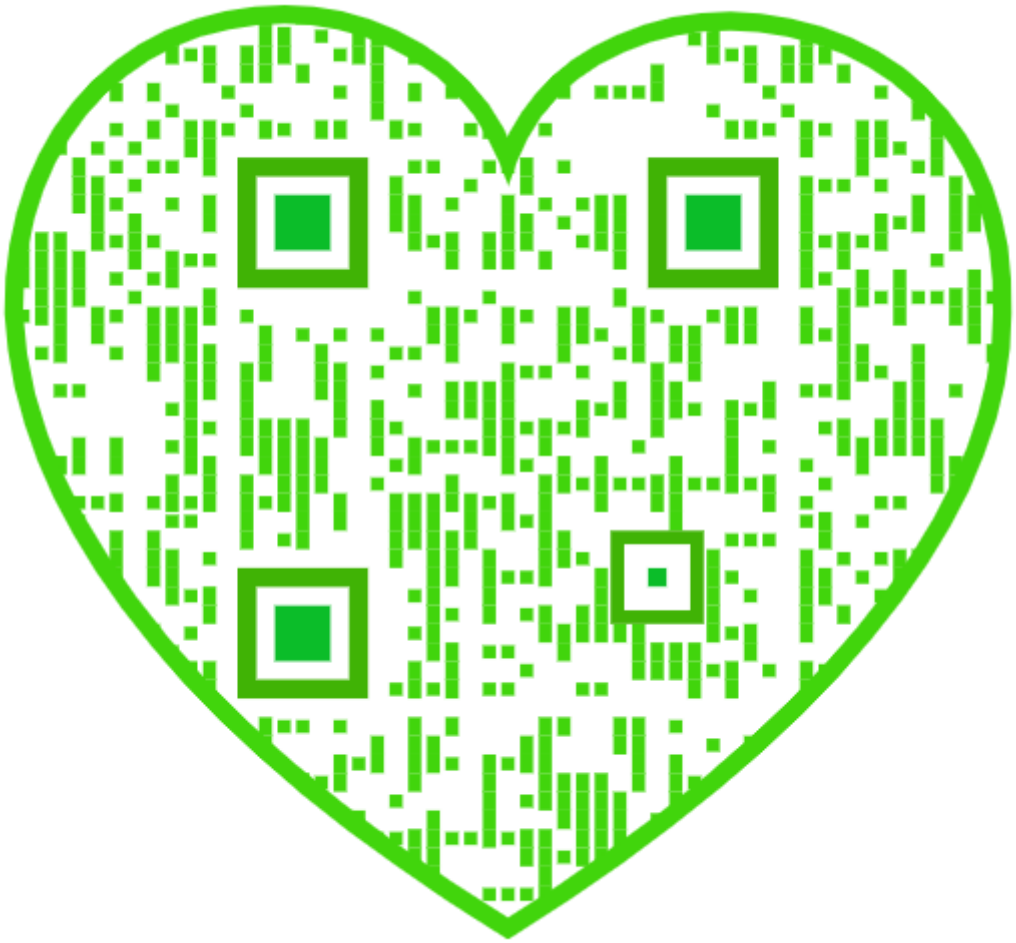

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A SHIP RAILWAY TO ASSIST THE PANAMA CANAL.

The indefatigable de Lesseps has been forced to take a backward step in the construction of the trans-isthmian canal. Finding the work far from complete and his capital approaching exhaustion, he has determined to construct the canal for the present with locks. He has engaged Eiffel, of Paris, the builder of the great 250 meter tower of the coming exposition, to construct for him a series of iron locks. These he proposes to place upon the line of the canal, and for the present to carry vessels across the high ground between Panama and Aspinwall by means of the locks. This is by no means to be interpreted as an abandonment of his original project of a canal without locks. But as a source of revenue, it is absolutely essential that the canal should be in receipt of tolls. Without receiving an income at an early date, the work may have to be abandoned.

This does not mean simply the failure of an engineering project. It means the ruin of thousands of small investors, whose savings of years of toil are represented by the unfinished excavations on the isthmus. To save them from ruin, and to save France from a financial crisis which their ruin will inevitably entail, the canal must be finished. The construction of temporary works is fully justified. It is the only way of securing a return from the use of the canal for many years.

De Lesseps proposes to adopt locks and a high level reach. It seems far from certain that he will have sufficient water to supply the locks. If pumping has to be resorted to, at once an immense expense, both of capitalization and running costs, will be incurred. An American engineer, resembling de Lesseps and Eiffel in the greatness of his conceptions, one who has left behind him monuments of engineering equal to the greatest of their works, has provided the remedy for the trouble that now hangs over the Panama canal. His first work affected the internal improvement of his own country. After bridging the Mississippi, he deepened its channel, making the river itself do the work of removing the silt accumulations of many decades. He next turned his attention to a wider field—the removal or surmounting of the barrier between the Atlantic and Pacific Oceans. His work hitherto had been characterized by its practical features. For crossing the isthmus he designed a no less practical plan—a ship railroad. He proposed to raise the ocean craft upon cradles, and carry them on a specially constructed railroad across the land surface, from ocean to ocean.

Our allusion is to Captain J. B. Eads. We have so often spoken of this, his greatest conception, that our readers must be familiar with its details. Suffice it to say that it has seemed to us to afford the solution of quickest achievement of the world's great problem. It may yet effect this result. But here we desire to call attention to it as an adjunct to de Lesseps' work. A railroad already runs across the isthmus. A practicable route is thereby determined. For the transit of ships over the unexcavated line the Eads ship railroad would afford in every sense the best method.

A short railroad, a work of cheap construction as compared with canal excavation, would supply the missing link. In a tithe of the time required for the installation of locks and high level canal, and for a tithe of the expense necessary for their construction, the ship railroad could be carried through the forest. All the conditions are favorable for its use. What is needed to avert ruin from the company is an early opening of the canal. When in receipt of a regular income, the work of completing it on the original plan can go quietly on. Far superior in all respects to the lock plan, the ship railroad would answer the requirements. No question of water supply would affect its operations. A railroad already in existence is its pioneer. It is not impossible that with a railroad intended for temporary use in active operation, the original intent might be abandoned. We believe that the railroad would answer all purposes so perfectly that it would always be retained. Even if the canal were completed, a paralleling of the route would be of importance enough to justify the maintenance of the roadway.

But that is a side issue. Some hundreds of miles nearer Mexico, in Nicaragua, a party of engineers are actively surveying a route for another canal. The Nicaragua Canal Company, in their circular, speak of the collapse of the Panama canal, and promise an early completion of their enterprise. The engineering difficulties of the Nicaragua route seem to be far less. Pride is thus added to the incitements, already great, which urge an early completion of the Panama canal. The Eads method solves the problem perfectly. If every nerve is strained toward uniting the unfinished portions of the canal by a railroad, then and then only can hopes be entertained of seeing the French enterprise in active operation in advance of its American competitor. It is hardly saying too much to affirm that in the conception of the great American engineer is to be found the very salvation of de Lesseps' enterprise.

DR. J. A. JEASON recommends *asepin* in 1-grain doses, well triturated with liquorice, as a remedy for offensive eructations. To be taken after food.

The Great Illinois Ditch.

There has heretofore been a marsh of some 200,000 acres in extent on the west side of Mason County, Illinois, which lies along the Illinois River, that stream making the western boundary. This marsh, since the settlement of the State, has been great duck and other game hunting grounds, though considerable of a nuisance to the farmers living on its borders. This marsh has recently been drained by the Mason County Ditch Co., consisting of the farmers owning the adjoining lands and the outside proprietors of the marsh lands. The main ditch is 60 feet wide at top, 40 feet at bottom, and 8 feet deep. It is 15 miles long, has a fall of 4 feet to the mile, and drains with its laterals, which are 30 feet wide at top, 15 at bottom, and with a depth to correspond with the mains, from 200,000 to 300,000 acres. The cost of the whole is estimated to be $200,000. The earth removed is sand and clay mixed, and offers little resistance to the machinery. The dredge doing the work floats in the water of the ditch and makes 100 feet progress every day. The assessed cost on some of the drained land will ultimately amount to $25 per acre, and thence grading down to a trivial sum.

The work has been in progress for several years, and meantime the land drained has produced surprising crops of wheat and corn. The past year—a year of severe drouth—matters have not progressed as favorably in respect to crops, thousands of acres of corn having been lost by "firing," in consequence of the sudden withdrawal of the usual moisture. The thoughtful among the projectors of the scheme and owners of the land are now aware that they have made a mistake in not providing for holding a portion of the water, and recognize the fact that the ditch is twice the dimensions it should have been. If it were not for the fall —4 feet to the mile—a few locks or dams would hold the water when it will be needed for crops; but now it will take many.

Benner's Prophecies for 1888.

Samuel Benner, an Ohio farmer, who has gained considerable notoriety through the newspapers for his predictions of future events, and who a few years ago published a small volume on the ups and downs of prices, which had a great sale, has now communicated to the *Real Estate Journal*, of this city, his prophecies for the year 1888, in which he says:

"This year, 1888, being the closing year in this cycle of low prices—seven years from 1881—is the golden opportunity to commence the foundation for a business. If there is any benefit to be derived from a knowledge of these cycles in trade, it will be in taking advantage of them.

"Young men who are about to commence their business career should embrace their present opportunity. There are but few of these chances in an ordinary life. It requires about ten years to complete an up and down in general trade.

"When the depressions which follow commercial crises reach their lowest limit, as determined by these price cycles, they afford the best opportunities for investment, and the height of speculative eras are the most dangerous periods to make a commencement in any enterprise.

"This is the opportunity for investors to open a mine, to build a furnace, to erect a mill, to build a ship, to equip a railroad, and to make investments in agricultural, commercial, and industrial operations.

"George Peabody laid the foundation for his fortune by buying American securities in one of our commercial depressions."

Wild Ponies on the Southern Coast.

On the banks or sand bars that divide the Atlantic Ocean from Pamlico Sound, North Carolina, just inside the lighthouse that marks out to the mariner dreaded Cape Lookout, there is to be found a hardy race of ponies known as "bankers." These ponies have lived there as long as the tradition of the oldest inhabitant dates back. Entirely surrounded by deep water at all seasons, having no communication with the mainland, and being barren of vegetation save a scanty growth of sedge grass and low shrubs, the banks have remained uninhabited except by these ponies, which seem to thrive and multiply in spite of the hardships to which they are exposed. How they first came there, or of what origin, is conjecture, and tradition merely hints the story of a violent storm, with its attendant shipwreck and loss of all on board, save a lot of ponies from some European port, which were cast upon the sands, and, surviving the storm, became the progenitors of the race now so numerous.

Having to rely on instinct alone, these animals are a subject of study to the naturalist, as they are a prey not only to the driving sands, but to the storms of the cape, that break upon and over the narrow sand bar, and change with each recurring hurricane the topography of the country. The ponies, choosing the protected side of the hillocks, burrow deep into the yielding sand, and stamp out a protected stall, where they take refuge from the storm; and, while many are destroyed, their number has increased.—*American Agriculturist.*

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THE CELESTIAL WORLD.

A PARTIAL SOLAR ECLIPSE.

The second of the five eclipses of 1888 occurs on February 11. The sun is then partially eclipsed. The phenomenon is invisible in this country, but visible in the extreme southern part of South America, in the South Pacific Ocean, and at the South Pole. There is little interest attached to this eclipse, except that it forms one of the five eclipses of the present year. These five eclipses are the return of the five eclipses of 1870. A cycle of eclipses has been completed since that time. The ancient astronomers knew that after the lapse of a certain period the sun and moon returned to nearly the same position in regard to each other, and learned to compute eclipses from data thus obtained. The period was called the Saros, and takes, on the average, 18 y. 11 d. 7 or 8 h. for its completion, when a new cycle of eclipses occurs under nearly the same conditions.

The time, place of visibility, and the magnitude of the eclipse vary, but the general law is invariable. The eclipses of 1870 are repeated in 1888.

I. The total eclipse of the moon of January 28 was the same eclipse that occurred January 17, 1870, the interval being 18 y. 11 d. 8 h. 33 m.

II. The partial eclipse of the sun, February 11, repeats the eclipse of January 31, 1870, the interval being 18 y. 11 d. 8 h. 12 m.

III. The partial eclipse of the sun of July 8 and 9 repeats the eclipse of June 28, 1870, the interval being 18 y. 11 d. 6 h. 44 m.

IV. The total eclipse of the moon of July 22 and 23 repeats the eclipse of June 28, 1870, the interval being 18 y. 11 d. 7 h. 10 m.

V. The partial eclipse of the sun of August 7 repeats the eclipse of July 28, 1870, the interval being 18 y. 11 d. 7 h. 4 m.

COMETS OF 1887.

The first comet of the year, Comet *a*, was discovered on January 18 by Dr. Thome, of the Cordoba Observatory, Argentine Republic. It was a beautiful and conspicuous object in the southern hemisphere, with its tail 40° long, but refused to gladden the eyes of northern observers. The second comet, known on the records as Comet *b*, was picked up by Prof. Brooks, of Phelps, N. Y., on January 22, but was too small to be of much account. The third new comer in the cometic family was Comet *c*, detected by Prof. Barnard, of Nashville, Tenn. The same diligent observer found the fourth comet of the year, or Comet *d*, on February 16, and the fifth comet, or Comet *e*, on May 10. They were all telescopic comets, of little special interest or importance.

Prof. Brooks had the good fortune to detect the cometic prize of the year in the sixth comet, or Comet *f*. It proved to be the much wished for comet of 1815, or Olbers comet, on its first predicted return, after an absence of 72 years. It is also known as the Olbers-Brooks comet.

THE NEW ASTEROIDS OF 1887.

The family of asteroids was increased by the addition of seven members during the year 1887, so that it numbered at the close of the year 271 of these minor planets, the supply thus far seeming to have no end. No. 265, named Anna, was detected on February 25, by the indefatigable asteroid hunter Palisa, of Vienna. No. 266, rejoicing in the name of Aline, was found by Palisa on May 17. No. 267, Tirza, was picked up by Charlois, of Nice, on May 27. No. 268, still nameless, was discovered by Borelly, of Marseilles, on June 9. No. 269, nameless, was the third celestial prize won by Palisa, on September 21. No. 270, Anahita, was found by Peters, of Clinton, on October 8. No. 271, nameless, was discovered by Knorre, of Berlin, on October 16.

THE SATELLITE OF VENUS.

Observers, more than a hundred years ago, saw a small star in the neighborhood of Venus that bore many marks of being a satellite. If it had remained visible all the time, it would have been a satellite without doubt. The facts, however, that it was only seen at intervals, separated sometimes by twenty or fifty years, that the observations made were consistent with no possible orbit, and that it had not been seen for more than a hundred years, prove conclusively that it was not a real satellite. Many theories have been broached to account for the observations, but none of them has hitherto been tenable, and the enigmatical satellite of Venus has been considered one of the unsolved problems of astronomy.

A nearly satisfactory solution of the vexed question seems now to have been reached. M. Stroobant has found the key to the puzzle. He has sent a paper to the Belgian Academy of Sciences proving that in many instances the supposed satellite was actually a star. He was led to this conclusion by a thorough examination of all the appearances of the supposed satellite. He has embodied the result of his labor in a chart, extending from 1645 to 1768, including thirty-three dates, divided into eleven series, adding, in the form of an appendix, the requisite particulars referring to Venus, presenting an abstract of the theories invented to account for the satellite, reprinting the original observations and illustrating his own work by a series of star maps.

The conclusion of the whole matter is that, in several instances, Stroobant has identified the pretended satellite with small stars in the neighborhood of Venus at the time. In the observation of Horrebow, in 1768, he found the star to be Theta Librae, while in this, as well as in other cases, the observed movement of the satellite is precisely the opposite to the proper movement of Venus in relation to the star.

Theories usually have some drawbacks, and Stroobant's theory is no exception to the general law. One series of observations made in 1764 are still unexplained. It is not impossible that one of the brightest asteroids was near enough to the planet to be seen in the same field. The objection that some of the stars examined are too small to have been visible near the planet has been refuted by M. Stroobant, who found that by using a telescope of six inches aperture, stars of the eighth or ninth magnitude can be seen near Venus when she is not in her brightest phase.

It looks, therefore, as if this long pending mystery concerning Venus and her supposed satellite was in a fair way of being cleared up. The theory commends itself for its naturalness and simplicity.

Military Notes.

The experiment, begun some time ago in the German infantry, of doing away with socks and keeping the foot soldiers' feet well greased, has proved thoroughly successful. To say nothing of the economy of the plan, the men march easier, and, generally speaking, show few blisters. So, too, lifting the foot high; the regulation step now is said to make the most awkward Pomeranian or Hanoverian peasant fairly sure footed, while before its adoption 25 per cent of such men would stumble in a charge over rough ground, and about 10 per cent fall.

The report sent hither as to the performance of the Nordenfelt submarine torpedo boat at the recent official trial, and the order given by the British government for a fleet of them, seems to be a mistake. The craft only repeated what she did six months ago at Kronstadt—sunk out of sight readily and maneuvered in the subcurrent. She was not, however, able to affix a torpedo to the hull of an anchored ship without giving the hostile crew ample warning of her intention and movements. This and the fact that she has no defense against machine guns proved, in the judgment of the Admiralty board, sufficient to preclude her adoption, at least until the type to which she belongs shall have been further developed.

"Kriegspiel" (the game of war) is becoming almost as popular among British troops as it is in Germany, where it was invented. There is scarcely a regimental headquarters that has not the maps and blocks and lead soldiers of which the game is composed, and now the company and troop commanders are taking to buying them, and not a few sergeants' messes have them. "Kriegspiel," it should be explained, is really a game of instruction; having most of the advantages of a sham fight in the field, without its wear and tear, its waste of ammunition, and the delays consequent upon maneuvering in a friendly country where gardens and cultivated fields must be spared, navigation of rivers left unobstructed, and crowds of sightseers are ever in the way. Topographical maps are made of the neighboring region, usually on a scale of six inches to the mile, heights of hills and their exact contours are shown by curves, equidistant the one from the other, woods and fresh water are recorded as they exist, the depths, widths, and shore line of streams, together with the character of their bottoms, for the information of the pontoniers, are carefully laid down. The game is said to be invaluable as a means of instructing the soldier in field work and of training officers to successfully operate their commands in a strange country. The officer has his map as the pilot of a ship has his chart of a strange harbor, and, if the map is correct, it should enable him to move with as much precision and guard against certain contingencies as surely as though he were on familiar ground.

It was left for French ingenuity to find a use for dogs in war, and yet, remembering the instincts of the dog and his sagacity and faithfulness, it is surprising that no attempt till now has been made to systematize their use in outpost duty. Sentries on the outer line, as well as near the main body of an army or small body of troops, are often unobservant and sometimes sleepy, but a good dog is ever alert. Taking advantage of this, the French have organized what might be translated as a "field pack," which has been "brigaded" with the 35th of the line, now stationed at Belfort. The pack is composed of large, fierce animals, which, from the description given, would seem to be a species of mastiff, though the mastiff is known for his sagacity, strength, courage, and good disposition rather than for his scent, which is much inferior to that of hunting dogs. Curiously enough, it was Belfort, where the experiment is on trial, which the Germans so successfully "masked," and it is perhaps because the French are determined not to be again outwitted at this point that they are taking this extraordinary precaution. The dogs are deployed on advanced posts, and, while held in the slips, are taught to attack dummies wearing the Prussian helmet and uniform.

A new explosive for war purposes is described by the *MilitarWochenblatt* as composed of a carburet of hydrogen (aromatic) in solid form and concentrated nitric acid having a density of about 1·52. Separated, they are harmless; but mixed, as they are when discharged in a shell, a small glass tube of the second breaking while in flight and pouring over the carburet of hydrogen, the compound forms, it is said, a terrible explosive, which, however, must be fired by time fuse.

The Russians recently had a sham fight at Sebastopol in the Crimea. The ships anchored in the roads as were the allies in the Crimean war, sending a force ashore to assault the works. The landing was made under a heavy fire from the marine guns, and was replied to from the old Redan and the new works by what is described as a terrible crossfire concentrated, point by point, on the line of the advance from the sea. The *Wochenblatt* says that, while these guns remained in play, it is hard to see how such a maneuver as that of the Anglo-French armies could be repeated, even at night, for such is the disposition of the electric search lights that even the darkness of night would scarcely prove a sufficient cloak for such an adventure. It does not say, however, what might happen if those operating the lights were shelled out.

The *Souvenir de l'Azov* is the name of a new Russian cruiser (10,000 tons) said to be able to make 20 knots an hour readily and carry enough coal to steam 20,000 miles. She is partly armored, carries a heavy battery and two torpedo boats, and would seem, from what is said of her, to be a fine sea boat, stiff, easy, and buoyant.

The Time in which we Think.

One of the most beautiful applications of electricity which has of late been made is its use in the study of psychological phenomena. And why, indeed, is not the subtile power by which time and space are being annihilated, and human labor rendered less irksome, the most proper agent to assist man in the study of the facts of his own consciousness? In an elaborate article in the *Nineteenth Century*, Dr. J. McK. Cattell gives an account of the time measurements of thought made by means of the line drawn on a rapidly moving surface by a pen attached to the prong of a tuning fork vibrating at a constant rate, by means of electricity. By a delicate apparatus constructed on this principle, duration of time may be measured to the one ten-thousandth of a second. The writer above named has found that the process of thought varies in its degree of rapidity in different individuals, children and old persons thinking slower than people of middle age, ignorant persons thinking more slowly than educated persons. In this way he also found he could measure the time it takes to perceive, that is, the time which passes from the moment when the impression reaches consciousness until the moment at which we know what it is. In his own case he found that it took 1-20 second to see white light, 1-10 second to see a picture, 1-8 to see a letter, and 1-7 to see a word. It takes longer to see a rare word than a common word, or a word in a foreign language than in our native tongue. It even takes longer to see some letters than others. "Will time," or time taken up in choosing, can be measured. It takes 1-13 second to judge between blue and red. To recall the name of a printed word takes 1-9 second, to a letter 1-6 second, to a picture 1 4 second. It takes less time to remember the name of a familiar word than of a letter, though it takes less time to see the letter. The time of remembering can be measured. It takes 1-4 second to translate a word from one language to another when you are familiar with both. It takes 1-20 second longer to translate a word from a foreign language to your native tongue than it does in the other direction. We can think of the name of the next month in half the time we can think of the last month. It has been demonstrated that sensation does not travel through the nerves to the brain so fast as has been supposed. Its speed is not much greater than sixty miles an hour. —*Light and Heat.*

Bessemer Steel Rails.

According to the Bulletin of the American Iron and Steel Association, the production of steel rails by our Bessemer steel works in the first half of 1887 was 1,030,530 gross tons, and in the second half of 1887 it was 1,019,103 tons, or 2,049,638 gross tons in the whole year. The result was 487,228 tons greater than in 1886.

The new year, says the Bulletin, does not open auspiciously for our steel rail friends. Many large orders are still withheld, and the works which closed down in December are still idle.

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Old Ants and Aged Spiders.

Dr. H. C. McCook, in an interesting paper lately read before the Philadelphia Academy of Sciences, and reported in the *Ledger*, gave an account of the life history of a fine specimen of the spider commonly known as the American tarantula. The animal was given to him in 1882 by Dr. Joseph Leidy. It was then apparently 18 months or 2 years old, and it lived in captivity until July, 1887. At the period of its death, therefore, it must have been at least 7 years old, and may have been 8, having thus attained the distinction of being the most aged spider known to science. How long this species and other spiders generally live in their natural habitat is not known, but human protection in the present instance probably aided to prolong life. It was kept first in a glass globe, and afterward in a wooden box, with glazed sides and a sliding glass door at the top. One end was filled with dry soil, which was slightly compacted and heaped up. The other end was sparsely covered with earth. It was at all times liberally supplied with water, and its food consisted of live flies, grasshoppers, and locusts. During confinement the tarantula shed its skin several times, a process apparently attended with some danger, as it was during such a change the creature died; and once before, on a similar occasion, it was found apparently dead, although it afterward revived. It is possible that it was too much exhausted by long previous fasting to endure the severe strain which evidently is laid upon the organism in the act of moulting. The spring of 1887 was a backward one, and some difficulty was experienced in procuring insects for food from the immediate neighborhood. The annual supply of grasshoppers and locusts was very late, and it may be that, had the spider been strengthened by a few weeks' generous feeding previous to its last moult, it might have been still alive.

In connection with the general subject of the prolonged life of insects, Dr. McCook stated that during a recent visit to Sir John Lubbock at his house in London he inquired after a queen of the fuscous ant, which he had seen in an artificial formicary six years ago, it being then nearly 8 years old. He was told by his host that it had died the day before, having at the time reached the wonderful age of more than 13 years. She was still attended by her circle of courtiers. Some of these were licking the dead queen, or touching her with their antennæ, and making other demonstrations as though soliciting her attention, or desiring to wake her out of sleep. It was certainly a touching sight to witness these faithful attendants surrounding the dead body of one who had so long presided over the maternal destinies of the colony, and seeking by their caresses to evoke the attention which never again could respond to their solicitations.

AN ELECTRIC CARRIAGE.

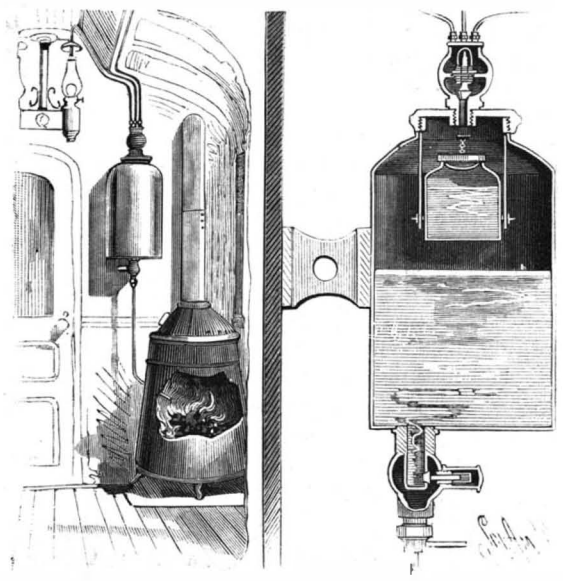
Mr. Magnus Volk, of the Brighton Electric Railway, has recently turned his attention to the application of electric traction to vehicles running upon ordinary roads. The dog cart represented in the adjoining engraving was built by Messrs. Pack, coach builders of Brighton, and is driven by an Immisch motor of ½ horse power type. The current is supplied by 16 E. P. S. accumulators, which at the normal rate of discharge are good for a six hours' run. The cells are placed under the seats. The motor is supported by hangers under the body of the car, and drives on to a countershaft in front by a Renold's steel link chain. Upon the inner side of the rim of the right hand wheel, which is four feet in diameter, are a number of blocks fixed about one foot apart, and a second steel chain passes from the countershaft around these blocks. The arrangement is neat in appearance, and has the advantage of reducing the weight of the gear to a minimum.

The motor at present employed weighs 40 pounds, though it is scarcely large enough for the work it has to do. The experiments so far made have resulted in obtaining valuable data as to the tractive force required for vehicles on roads of various kinds. On asphalt the tractive force is less than on a grooved rail, and a speed of nine miles an hour can be obtained, whereas on a soft macadam road only four miles an hour is possible. With a load of two persons a grade of 1 in 30 can be surmounted.

The vehicle is the object of much attention just now in Brighton, and taken altogether as a first experiment the results may be considered to be interesting and satisfactory. *The Electrician.*

AN IMPROVED FIRE EXTINGUISHER.

A fire extinguisher especially designed for use in connection with car heaters and lamps, by which the fire in either or both will be put out when the car is upset or subjected to a particularly violent concussion, is illustrated herewith, and has been patented by Mr. William H. Durant, of Concord, N. H. It consists of a tank containing a solution of bicarbonate of soda dissolved in water, with a valve in its bottom and pipes leading therefrom to the interior of the car stove or heater,

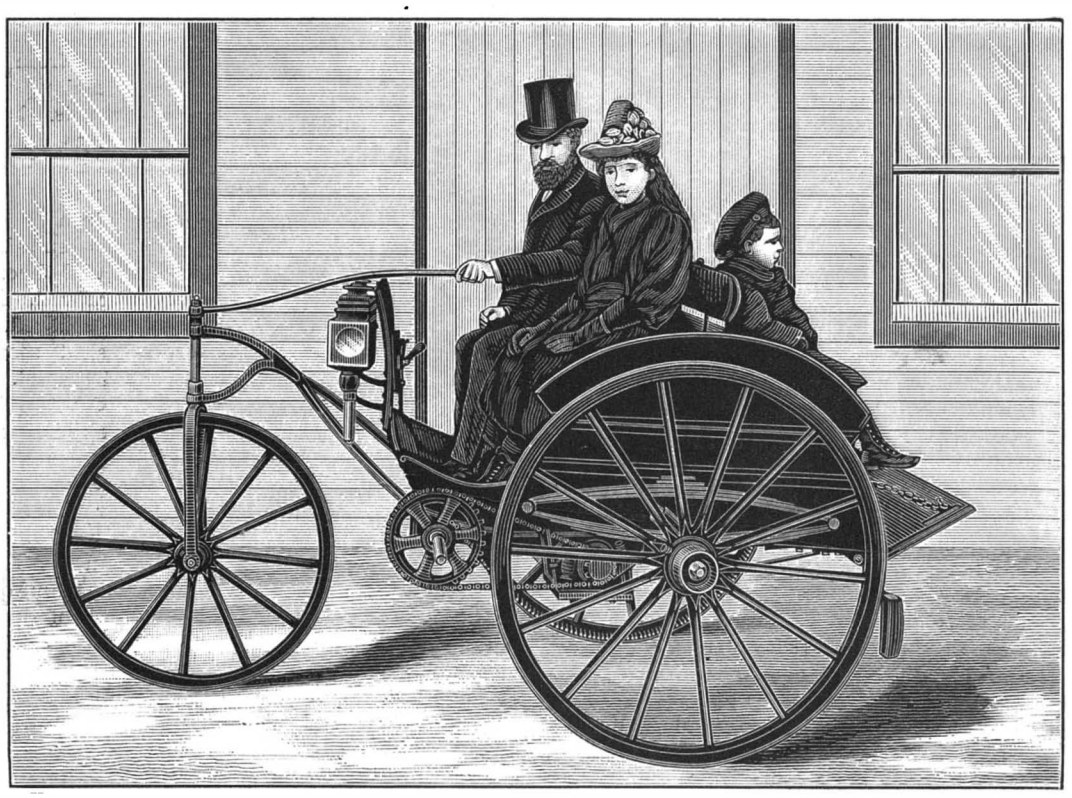


DURANT'S FIRE EXTINGUISHER.

while in the top portion of the tank a small vessel is held suspended containing sulphuric acid, which, when emptied into the bicarbonate of soda, produces carbonic acid gas. The sulphuric acid vessel is supported on trunnions in such way as to be overturned by a severe concussion, by which its stopper will be withdrawn and the acid allowed to flow into the tank, where the pressure produced by the consequent production of carbonic acid gas will force open the valve at the bottom, connected with pipes leading to the car heater, and the fire-extinguishing gas is thus conducted to outlets in proximity to the grate bars. A small extinguisher of this kind may also be readily applied to lamps, the extinguisher for a four-bracket light being placed in the center, with tubes leading over the mouth of the smoke bells to the lamp chimneys.

Jewelry Repairing.

Probably there is not anything upon which the reputation of a keeper of a jewelry store is more easily built up than the neat and substantial repairing of the jewelry of his patrons. The intrinsic value of a filled ring may be almost nothing, but to the owner it is surrounded by a halo of associations which give it priceless worth, and if broken by accident, its neat repairing is very highly appreciated. So, also, the cleaning of jewelry, which through discoloration has lost its beauty, is often looked upon with delight as marvelous.



AN ELECTRIC CARRIAGE.

Perhaps a few hints on this subject may be of use to some who have met with difficulty in making repairs to their satisfaction.

It is of the utmost importance that the use of soft solder be avoided as far as possible in repairing articles made of gold or silver, and even filled and plated jewelry may be repaired with hard solder.

To repair a ring, the shank of which requires soldering, bury the head in a crucible full of wet sand, place a small piece of charcoal against one side, coat the break, previously cleaned by filing or scraping, with borax, and charge with solder; blow a flame against the ring and charcoal until the solder runs in. For articles which require to be protected against discoloring in the process of soldering, coat them with a mixture of burnt yellow ocher and borax, adding a little dissolved gum tragacanth to make it lie all over, allow it to dry, then charge with borax and solder and heat sufficiently. Boil out in weak pickle made of nitric or sulphuric acid. One important point is to wash the piece well in hot water with a little ammonia in it before attempting any repairs. This removes all dirt and grease, which, if burned on, cannot be removed.

If the article be of colored gold, boil out in pickle made of muriatic acid, and never coat with any protecting mixture. The solder must vary in regard to fusibility according to the quality of the article. For repairing most filled work, very easily melted solder is required, which may be made of 1 ounce of fine silver, 10 pennyweights hard brass wire, adding 2 pennyweights zinc just before pouring; or, to make it more fusible, use bar tin instead of zinc; or, for stronger silver solder, use only the silver and brass. For repairing most bright gold work, use gold coin, 3 pennyweights; fine silver, 3 pennyweights; fine copper, 2 pennyweights. For colored work, fine gold, 1 pennyweight; silver, 17 grains; copper, 12 grains; hard brass wire, 2 grains.

A good solder for repairing spectacles or other steel work is made by melting together equal parts of silver and copper. In soldering steel, plenty of borax should be used.

Very often the want of a rolling mill is a great obstacle to the making of solder, but it may be flattened very thin, although not with great regularity, by pouring on to a flat piece of wood, and putting on it the flat surface of a piece of iron while it is still in a melted condition; a piece of cigar box is good to pour it on, as the odor emitted is not very disagreeable, and the solder may be melted in the hollow of a piece of charcoal, by using gas and a blowpipe.

For cleaning colored gold, a mixture of one pound sal soda, one pound chloride of lime and one quart of water will be found useful. It should be placed outside the building after mixing, and when settled the water poured off and the sediment thrown away; with great care this may be used for cleaning gilt bronzes and cheap gold and plated jewelry, but caution is necessary, as it will corrode brass very rapidly.

To remove lead solder from badly repaired jewelry, place the piece in muriatic acid and leave till the lead is eaten away. It is best always to heat the piece gently and brush off the lead, while melted, before subjecting the piece to the action of the acid, as too long a steeping is not desirable.

Set pearls, which have become discolored by wear, may often be improved by placing in a covered vessel with a mixture of whiting, ammonia, and water, and permitting them to remain for a few hours.

A good powder for cleaning jewelry, silver watch cases, etc., is made by mixing about four parts of whiting with one of rouge, using with alcohol or water; this, it will be found, is easily brushed out of crevices, engravings, etc.

Many are not aware of the fact that gold and jet jewelry, which has been worn so much for years, can be hard-soldered with easy-running solder without removing the jets, but it is easily accomplished by coating the gold with ocher, and laying the piece with the jets up while soldering, care being taken not to smoke the jets. An alcohol lamp is perhaps preferable to gas for this purpose, but in most cases gas answers best for soldering.—*Jewelry News.*

A SUBSTITUTE for gum arabic, patented in Germany, is made as follows: Twenty parts of powdered sugar are boiled with 7 parts of fresh milk, and this is then mixed with 50 parts of a 36 per cent solution of silicate of sodium, the mixture being then cooled to 122° Fah. and poured into tin boxes, where granular masses will gradually separate out, which look very much like pieces of gum arabic. This artificial gum copiously and instantly reduces Fehling's solution, so that if mixed with powdered gum arabic as an adulterant, its presence could be easily detected. The presence of silicate of sodium in the ash would also confirm the presence of adulteration.

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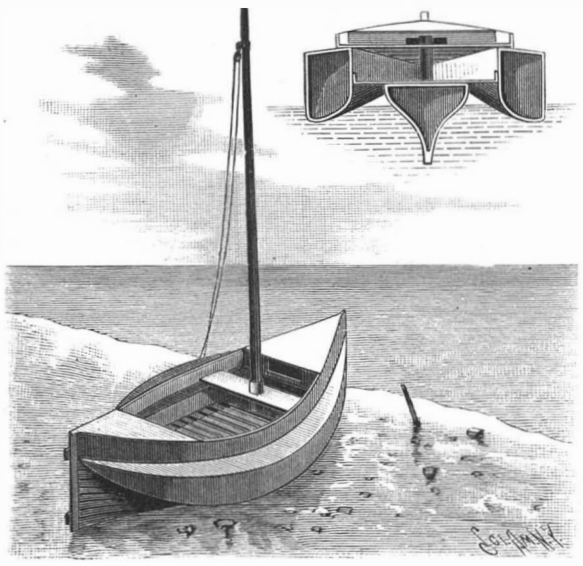
AN IMPROVED LIFE BOAT.

A life boat designed to be unsinkable and not liable to be capsized, and in which compartments are provided from which the passengers cannot be washed out, is shown in the accompanying illustration, and has been patented by Mr. John A. Aniello, of Biloxi, Miss. It is formed of two air and water tight side sections and a similar central section, as shown in the small sectional view. A grated flooring is arranged above the central section and between the side sections, and compartments adapted to receive passengers are arranged at either end of the boat under a deck which extends from bulwark to bulwark, grated floorings being arranged beneath these decks. The air and water tight side compartments, being above the central section or compartment, render the boat practically non-capsizable, while the air spaces are designed to be of sufficient size to safely float the boat with its largest practicable load.



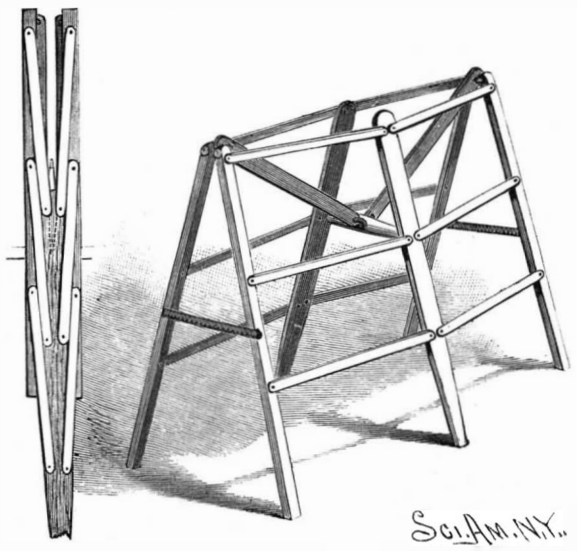
ANIELLO'S LIFE BOAT.

HARDING'S IMPROVED COUNTER.

The demand for an improvement in the line of speed indicators has led Messrs. E. R. Harding & Son, of Leeds, England, the well known makers of large engine indicators, to introduce a small one that is at once compact, accurate, and convenient. It is nickel plated, incased in velvet-lined leather case, and has an attachment for indicating the rotation of a shaft or spindle, as shown in the accompanying cut. It is a useful addition to a mill manager's or machinist's outfit. Messrs. Harding & Son make all kinds of self-registering indicators, from four to seven figures, for steam engines, turbines, shafts, and machinery in general. Messrs. Stoddard, Lovering & Co., 152 Congress St., Boston, Mass., are their sole agents in this country.

AN IMPROVED FOLDING CLOTHES FRAME.

A simple form of folding clothes frame has been patented by Mr. Samuel F. Burgess, of West Morris, Litchfield County, Conn., and is shown in the accompanying illustration, in a side view, folded, and as extended for use. It consists principally of two central braces connected to the upper ends of the end uprights of the frame, and connected also at their adjacent ends to a central brace for spreading apart and bracing the center uprights. The end uprights are connected together at their upper ends by U-shaped wires, on which they are hinged, and are also connected together lower down by flexible tapes or strips, to prevent their spreading too far.



BURGESS' CLOTHES FRAME.

Steam Heating of Cars.

The heating of cars by steam has at last met with a genuine experience with the worst conditions that it can expect to ever be called to meet, viz., the bitter cold and blockading snow of a veritable northwestern blizzard. From the 12th to the 17th of last month a steam-heated train on the Chicago and Northwestern Railway struggled with snow and cold on a special run from Chicago to Des Moines, Iowa, 363 miles, and return. Seventeen hours of this time were spent in a snow drift. During the trip the temperature of the outside air ranged down to 29 degrees below. The cars were kept comfortable through all this. When the engine was detached to seek release from the snow drift, the cars were kept warm with the Baker heaters.

Steam heating is shown in this experiment to be here to stay, despite the cavil of unbelievers, for it has successfully carried a train through conditions that reach the maximum of severity in our latitudes. But it has also been shown that we are as yet only upon the threshold of the science of steam heating, for these severe conditions have brought out defects that must be removed before ordinary train hands can be trusted to carry it into a blizzard. We confidently expect that these defects will be remedied.—*Railway Review.*

AN IMPROVED WINDOW SILL.

A window sill designed to be strong and durable, and which when set in place will present a neat finish, excluding rain and snow, and protecting the wall of the building, is illustrated herewith, and has been patented by Mr. Hynek Breuer, of New Prague, Minn. It is preferably made of iron or steel, of one piece of metal cast in the ordinary way, having a ledge or plate which rests on the wall of the building and an ornamental or moulded front pendent portion. At its inner edge the sill plate has an upwardly projecting lip or flange designed to enter a groove made in the under side of the sill of a window frame built into the wall. The small views show cross sections of sills of different moulded forms.

Chinese Trade Unions.

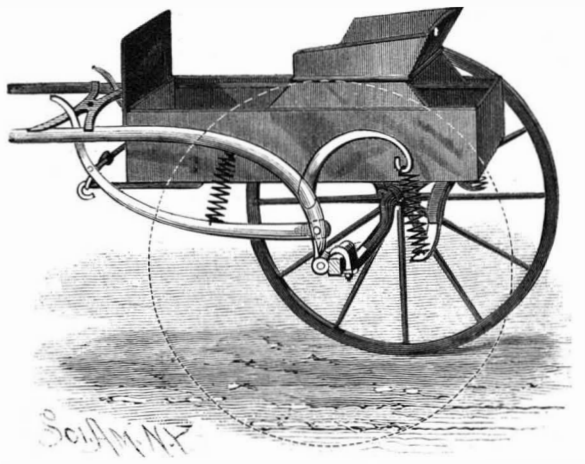
The Minister of the United States at Pekin, China, transmits to the State Department at Washington an interesting article on the Chinese guilds, in which it is shown that every branch of business and every trade is arbitrarily controlled by these despotic organizations. The trade unions boycott oppressively, regulate hours, apprentices, cause strikes, and adjust prices in a very complete manner. The guilds all have guild halls, with very expensive decorations, they being arranged for use of the members somewhat as are our club houses. The methods of the trade guilds are somewhat novel. One member of the gold leaf craft at Soochow recently violated the rule, and took more than one apprentice at one time. His union punished him by biting him to death. The union was composed of 123 men, and each member set his teeth in the flesh of the offending brother. Other penalties for slight infractions of rules are: the furnishing of a theatrical performance, a feast for over ten, and quantities of liquors. While their rule is, undoubtedly, very despotic, the minister considers them not altogether harmful, as they administer justice and compel their members to act honestly.

AN IMPROVED PUMP.

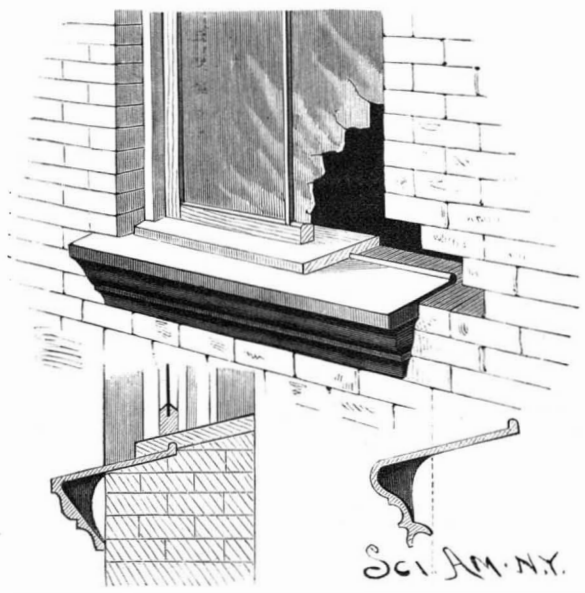
An invention providing means for securing a pump in place in a well, and for preventing oil or water from running down in the well and washing its sides, also providing the pump rod with a valve for allowing the water to be drawn out when removing the pump from the well, is illustrated herewith, and has been patented by Mr. Stephen La Point, of Yankton, Dakota Ter. To the body portion of the pump are pivoted arms or spurs, which project through openings in a loosely fitting conical sleeve, the upper end of the sleeve being screwed on the lower end of a larger valve casing. The plunger is operated through a stuffing box in the lower end of the casing, being connected with an upwardly extending pipe by means of a coupling, in which a valve is arranged, while above this coupling, and within the outer casing, is another valve casing, with which the upwardly extending pipe is also connected. In inserting the pump in a well the casing and conical sleeve are so held up that the arms or spurs will not project beyond the sleeve, but after the pump has been lowered to place the spurs will be thrown outward, as shown in dotted lines in the sectional view, and into engagement with the sides of the well, thereby holding the pump firmly in position. To remove the pump, as the casing and sleeve are drawn up by means of the pipe, the spurs are disengaged from the sides of the well, and at the same time the valve in the upper inner casing is opened, allowing the oil in the pipe to flow therefrom into the outer casing, saving the oil and preventing it from washing the sides of the well. In the perspective view the pump is shown arranged to work by a weighted pendulum, the walking beam having also a weight to balance the pipe. Where a well is too small to allow of this arrangement, the anchor can be loaded to hold the pump down.

AN IMPROVED TWO WHEELED VEHICLE.

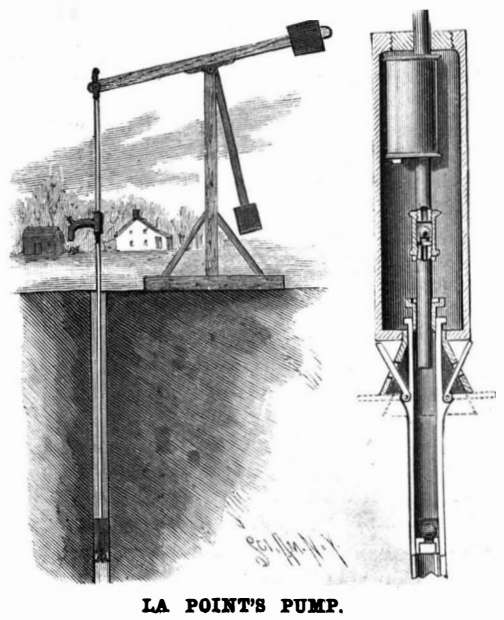
A two wheeled vehicle in which it is intended that the seat shall be free from horse motion, and wherein, should one wheel strike an obstruction, the tendency to throw the rider sidewise will to a great extent be obviated, is illustrated herewith, and has been patented by Mr. Henry K. Olmsted, of Victoria, Ill. The thills are rigidly clipped to the axle, the shafts being connected in front of the wagon body by a bar with bifurcated ends. In the forward face of each thill, above the axle, is pivoted a curved arm, the other end of which is carried upward through the end spaces of the bifurcated bar, the thills and arms being connected by a coiled spring, of such tension as normally to keep the upper ends of the arms in contact with the rear members of the bifurcated bar. At the rear end of each of the thills is also secured a curved steel bar or bracket, to an eye on the outer end of which is attached one end of a coil spring, the other end being connected with one end of a transverse semi-elliptic spring on the bottom of the wagon body. This attachment may also be applied to other styles of vehicles.



OLMSTED'S TWO WHEELED VEHICLE.



BREUER'S WINDOW SILL.



LA POINT'S PUMP.

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THE IMPROVEMENT OF NEW YORK HARBOR.

(*Continued from first page.*)

on so complicated a problem, Col. G. L. Gillespie, of the United States corps of engineers, then in charge of the New York district, was directed to make a survey of the whole harbor of New York. This was done by order of the Secretary of War through the chief of engineers.

The survey was commenced in August and completed in December, 1884, and reflects great credit on Colonel Gillespie, as well from its thoroughness as from the short space of time in which it was done. Soundings were taken by lead line from a tug boat which was kept in constant motion over the ground. Every half minute a sounding was taken and recorded, and every second sounding was located by sextant observations referred to fixed points on shore, whose geographical positions had been determined with great accuracy. With regard to the exactness of this method as compared with rod soundings, comparative tests have been made where part of the ground has been gone over by both, and it has been found that the rod soundings show a less depth than the line soundings by an average of six inches. A fourteen pound lead was used, and the line was compared at frequent intervals with a steel tape in order to verify its accuracy, and when not in use was kept lying in fresh sea water. The object of the survey was not only to determine just what was to be done to improve the harbor to the greatest advantage, but it was also designed to ascertain whether any shoaling of the channels had taken place.

The results obtained in this 1884 survey were compared with the first accurate coast survey made in 1835, nearly fifty years before, and no shoaling whatever during this period of years was shown, and it was proved that a 23 foot channel had been maintained by the natural scour of the ebb tide.

It was not certain, however, that a greater depth could be maintained, and therefore Colonel Gillespie, while advocating dredging the channels to a depth of 30 feet at mean low water, with a width of 1,000 feet, stated that in all probability the only way to maintain a 30 foot depth would be to contract the tidal prism by means of a dike starting from Coney Island and running toward Sandy Hook in a general southwesterly direction, on the ground that the contraction of the tidal prism would increase the ebb scour.

Colonel Gillespie's report was referred to the board of engineers for fortifications and rivers and harbors, who generally concurred in Colonel Gillespie's plan. It was proposed to leave an opening in the dike for the Coney Island channel, which is, to a large extent, used by the Coney Island and Rockaway steamboats and by oyster smacks and other small vessels from the Great South Bay and other points on the shore of Long Island. Such a dike would close the 14 foot and East channels. But these two are avenues of comparatively little importance, and their closing would be fully justified were the Main channel and Swash channel thereby benefited.

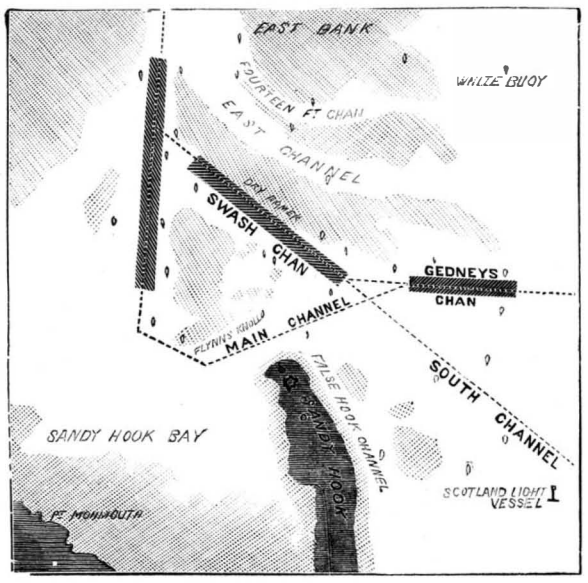
Estimates were made of the expense of improving Gedney's and the Main Ship channel, placing it at about $1,000,000; but as this did not allow for the increase of 30 per cent due to scow measurement of dredgings, because it referred to material in place, the total cost of this estimate rises to $1,370,000.

As the act appropriating the $200,000 specifically stated that it should be applied to Gedney's channel, bids were asked for to do the work there, and it was commenced by hydraulic excavators, with large centrifugal pumps, which raised the material from the bottom. These excavators were not self-propelling. A tug boat was used to tow them up and down the channel. By their use a general increase of two feet in depth over a width of 1,000 feet was obtained. Before this first appropriation was exhausted, a new appropriation of $750,000 for general improvement of New York harbor was voted, August 6, 1886. The matter of the expenditure was referred to the board of engineers, who decided to apply the appropriation to dredging only, as it was not thought that the dike was needed, for the present at least, as in any event the channels would have to be deepened.

We illustrate the apparatus now in use by the Joseph Edwards Dredging Company, who are the sole contractors under this appropriation. Their fleet of vessels comprises three propellers, each fitted with two Edwards centrifugal pumps and two dredging scoops connected by pipes with the pumps. Each vessel is divided by bulkheads into tanks for the reception of the dredged material. In the bottom of each of the tanks are valves, worked by horizontal valve wheels. By proper conduits the dredged material can be delivered to any one of the tanks, according to the way in which the chutes are set.

The estimated capacity of the plants per working day are: No. 1, 2,000 cubic yards; No. 2, 1,500 ditto; No. 3, 3,000 ditto; giving a total capacity of 6,500 cubic yards. All the material is taken outside of Scotland Lightship and dumped at a distance of about 8 miles from the Main Ship channel and 5 miles from Gedney's channel, in not less than 14 fathoms of water.

The general operation is as follows: The scoop is dropped down to the bottom, on which it runs upon wheels. The pipe which connects it to its pump is of steel, containing a ball and socket joint and including also a short length of heavy India rubber pipe re-enforced with steel bands, in order to prevent breakage when the vessel is rolling or pitching in a seaway. By means of a steam jet connected with the top of the centrifugal pump, a vacuum is produced within the pump and pipe, under the effects of which vacuum water rises through the pipes until the pump chamber is completely filled. Then, on starting the pump and opening the outlet valve hitherto closed, it at once

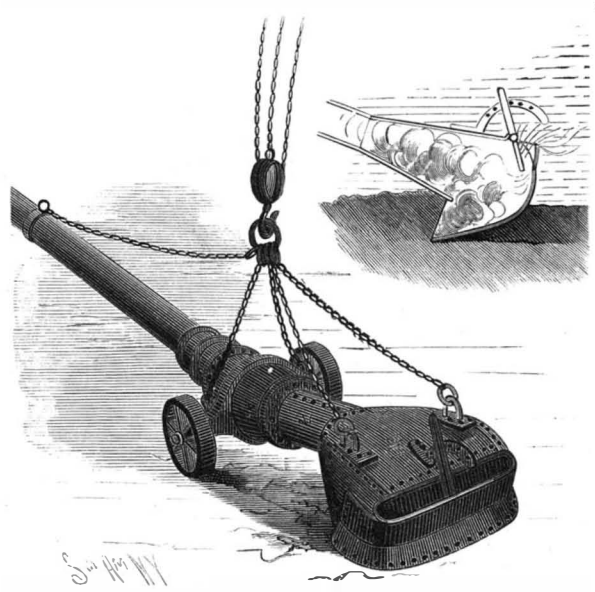


CHANNELS OF NEW YORK BAY.

begins to draw up material. At the upper surface of the scoop, a foot or so above the bottom of the water, a water valve is arranged which may be opened or closed by means of a small rope or lanyard. This is done from the deck of the propeller, and regulates the proportions of water and solid material. The operative can tell by the sound of the pump whether it is receiving too much or too little solid material, and sets the valve accordingly.

In dredging, the boat is made to advance at the rate of from one-half to two miles an hour, while both pumps are driven as fast as may be. It is very important to drive them to their full capacity, as they possess a critical speed below which their efficiency is greatly reduced. The boat thus travels down the channel, dragging with it the scoops, which are continually raking up the ground, which, as fast as it is loosened, is drawn up through the pipes by the pumps. The suctions are attached to the sides of the boat about midship, so that they are unaffected by pitching, while, owing to the great width of the boat, its rolling is so slight that they are not thereby disturbed.

As soon as the ice permits, work will be in full progress over the channel. At the present time a 600 ft. channel of a nearly uniform depth of twenty-six feet has been secured through Gedney's channel. The several soundings of the channel were located in the most



DREDGING SCOOP AND SUCTION PIPE.

accurate possible manner. Tripods, or other fixed stands, were erected in the water on one side of the survey, on which platforms were mounted. Upon these transits were placed, with attendant engineers. A boat was then allowed to drift down the channel within a given range, with the tide, and soundings were taken from her stern with a pole terminating in a flat plate of iron, to prevent penetration of the bottom.

As each sounding was taken the signal was given and the spot was located by transit observations. The geographical position of each of the tripods (or transit stations) had been accurately located beforehand, which eliminated any possibility of error.

This survey was executed during the past fall, and is a monument of hydrography. It is proposed, in spring, to execute a second survey of similar character, in order to ascertain whether any change has occurred during the winter storms. A survey made at the close of the work, in December, 1886, and another made before work commenced, in the summer of 1887, showed that, instead of shoaling, Gedney's channel had slightly deepened during the winter.

As the work is now being executed, there is every promise that in a short time the harbor of New York, as regards approaches, will be excelled by no harbor on the Atlantic coast, as it is excelled by none in the world in the anchorage and shelter it affords vessels when they have once entered it.

Up to the end of 1885 this work was in charge of Colonel Gillespie, corps of engineers, who is now stationed in Boston, and who was succeeded by Colonel Walter McFarland, corps of engineers, who is at present in charge.

Steel Pipes.

According to the Chicago *Tribune*, the piping for natural gas to that city will be made as follows:

A mild steel disk of the required size is folded under heat by several applications of specially designed machinery into the structure of the steel, and made proof againt rust, even muriatic acid producing no effect upon the metal. It is then drawn cold over mandrels, which has the effect of producing the form of a tube. It is then put upon a mandrel and rolled to any desired length. It is next cleaned with acids and treated to a preparation of tin, inside and out, which permeates its thickness and increases its tensile strength 25 per cent. The result is very similar to that reached in steel wire.

An idea of the strength and temper of the metal so treated may be gained from the fact that receivers have been produced under this process whose thickness is 41-1000 of an inch and whose bursting pressure is 600 pounds to the square inch. The comparative cheapness of the process is shown by the following figures:

A twelve inch steel piping, whose bursting pressure is one thousand and one hundred pounds, can be sold at a handsome profit for $74.67 per hundred feet, while the cost of wrought iron and cast iron piping of much less bursting pressure is $211.25 and $150 respectively. Another interesting comparison is as follows: Twenty miles of twenty-four inch seamless steel piping one-eighth of an inch thick will weigh three million pounds. The same piping, if it could be made of welded iron—as a matter of fact it cannot—would weigh 12,600,000 pounds. The same piping made of cast iron will weigh 26,755,000 pounds. In each case the bursting pressure of the steel is nearly twice that of the iron, and in addition a glass surface and a "positive" (non-leaking) piping is warranted. The piping will be made in all sizes, from thirty-six inches in diameter, and even larger if required, to the smallest used, and will probably be in lengths of twenty feet.

Little Things that Kill.

At various times the newspapers have warned the public against swallowing the seeds of grapes, oranges, etc., because of the danger of such substances getting into a small intestinal bag, or cul-de-sac, called by doctors the *appendix vermiformis*. This is a receptacle formed at the junction of the large and small intestines, but its use or object no physician knows. It has been thought to be a rudimentary or incomplete formation—or possibly some meaningless survival of a lost anterior type. At any rate, its existence, while presenting no apparent "reason for being," as the French say, is, on the other hand, a positive and constant source of danger, because of the liability of its becoming the receptacle of some undigested seed or other indigestible substance. In that case it produces a state of inflammation, which, in nearly all cases, proves fatal. Fortunately, but few seeds among the great number so heedlessly swallowed seem to get into this little death trap—although any one seems likely to lodge there. Perhaps more cases of inflammation of the bowels than the doctors suspect may be, in reality, due to this obscure and disregarded cause. One sad case which to-day produces a feeling of deep regret among thousands, and which plunges a family into overwhelming grief, occurred in this city recently, in the lamented death of J. Robert Dwyer, the much esteemed adjutant of the governor's foot guard—a man whose place that corps cannot make good. His case so baffled the physicians that an autopsy was had, and that revealed a piece of peanut shell in the *appendix vermiformis.—Hartford Times.*

THE annual statement of the Ætna Life Insurance Company, which appears in another column, is a strong financial exhibit. In every department of its business the Ætna makes a gain. In surplus, $77,753.04; in assets, $1,074,746.99; in new business, $1,352,456; and in insurance in force, $5,109,365. The Ætna's new business annually exceeds that of any other life insurance company located in the New England States.

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The Electrical Sewage Process.

Much attention is being drawn to a process devised by Mr. Webster for purifying sewage by means of electric action. This scheme is not, as we have heard it asserted, of "an entirely novel character." As far back as 1858 Mr. J. Chisholm obtained a patent for treating sewage by means of electricity, and described eight methods for effecting his object. Mr. C. F. Kirkman, in 1870 (No. 2,653), claimed an arrangement by which a continuous current of electricity is made to pass through the sewage. In 1873 Mr. F. H. Atkins (No. 556) applies "galvanic, magnetic, or electric action to . . . tanks, for the purpose of precipitating organic or inorganic matters in suspension or solution." Mr. E. H. C. Monckton, in 1874 (No. 265), passes sewage through electrified channels, and uses windmills as a power to generate electricity for purifying sewage. Finally, Mr. F. Herbert, in 1883 (No. 5,850), proposes an electrolytic process for the treatment of sewage, dispensing with chemicals and filter beds; and M. Hermite, the inventor of the electric bleaching process, has also quite recently proposed a method of treating sewage electrolytically. But though the general idea of the process is thus by no means novel, it is perfectly possible that Mr. Webster may have introduced some improvement which renders his process both legally valid and practically useful. On these points it is our duty to suspend judgment until fuller and more precise information is laid before the public. The inventor uses no chemicals save such as are created in the water by the action of the current upon the electrodes and upon the sewage itself. The quantity of precipitating matter thus created will not, it is said, exceed 1 grain per gallon. This is a very small amount, since, according to the scheme which the Metropolitan Board of Works propose to apply, 3½ grains of lime and 1 grain of copperas are to be used per gallon, and this is considered by practical men a very small dose. One great point in Mr. Webster's favor is that he does not introduce lime, and that his effluent water will probably therefore be free from the dangerous quality of alkalinity. The nature of the precipitants generated will of course depend on the metals of which the electrodes are composed. If these consist, as is probable, either of zinc, tin, lead, iron, copper, or aluminum (?), the precipitant must be a salt of one or other of these metals. Salts of tin and zinc are, of course, inadmissible in sewage treatment on account of their highly poisonous nature. Metallic aluminum is, we fear, as yet too costly. The choice then seems to lie between iron and copper. Now, it seems to us that a pound of iron in the shape of copperas can be bought more cheaply than a pound of iron first brought into the metallic state and then redissolved by the action of the electric current. That in Mr. Webster's process the precipitate will be buoyed to the top by the hydrogen gas resulting from the decomposition of the water is a matter of course.

We are by no means surprised that the suspended matters are said to be precipitated by the electric current just as are carbonaceous and metallic particles in air.

As regards the working cost, experiments made on the small scale seldom furnish a correct basis for calculating the cost when it comes to actual practice. Mr. Webster will have the advantage of competing with one of the most anti-economical schemes ever projected. If his deposit is useful as manure, London may at least be saved the crowning extravagance and waste of conveying manurial matters away and casting them, not upon the land, but into the sea to poison the fishes.—*Electrical Review.*

Light from Incandescent Bodies.

Referring to the above subject in a recent number, the *Revue Scientifique* pointed out that although it is generally admitted that when a solid body is heated it begins, at about 525° C., to emit red rays, to which are successively added radiations more and more refrangible as the temperature increases, the investigations of M. Weber have led to different results. By observing, in an absolutely dark room, either an incandescent lamp, excited by a current of gradually increasing intensity, or plates of different metals heated by a properly adjusted Bunsen burner, he found that the emission of light begins at a temperature much below that above mentioned, with the production of very pale gray rays, the refrangibility of which is equal to that of the yellow and greenish-yellow rays of the central spectrum. As the temperature rises, the light emitted grows yellow, and gives in the spectroscope a wide gray band, whose center is tinged with grayish yellow. At low red, a narrow red line appears at one side of this band; and almost at the same time a green band, large and of slight intensity, appears at the other side. The temperature still rising, the spectrum spreads both toward the red and green ends; and M. Weber further ascertained, by means of a thermometric element soldered to the plates, that the first traces of gray light are emitted at a temperature varying with the nature of the plate—about 396° C. for platinum and about 377° C. for iron.

A Two Foot Gauge Railroad.

An interesting account of the Bridgton & Saco Railway, one of Maine's two foot gauge roads, is given in the Boston *Transcript* by Chas. O. Stickney. He says that South American railway projectors have lately been examining the road with a view to using the idea in their work. From this account we take the following: The origin of the two foot road is of recent date. Its inventor, Mr. George E. Mansfield, of Boston, only a few years ago first demonstrated its feasibility by a ten inch gauge road, a little over one-eighth of a mile long, in Hyde Park, Mass., adown whose straight sections and sharp curves, on a little open car, run simply by gravitation, which "that crank Mansfield," as he was then termed, safely carried members of the legislature, of the press, and other representative men. Next, the Bedford & Billerica two foot road, eighteen miles long, the charter for which was obtained after a protracted struggle, which proved the entire practicability of the theory. For business reasons purely, in a year or two, the rails and rolling stock were sold to the Sandy River Railroad Company, in Maine, where they are successfully used to-day.

As our narrow gauge road, the Bridgton & Saco River, which taps the Portland & Ogdensburg (standard gauge) at Hiram, sixteen miles west of Bridgton and forty miles west of Portland, is a representative, and one of the best representatives, of its kind, I will take it for illustration. The general reader, as well as railroad men, will readily note its unique, curious, and interesting features.

The road was built in the summer of 1882 and the winter of 1882–83. That winter was notable as one of the most severe on record, the mercury for weeks at a time registering from 5 deg. to 25 deg. below zero, and the snow being deep; which, with the then high price of materials, made the expense much more than it would cost to build the same road at the present time. The exact length of the road is 15·9 miles, independent of sidings. The cost of construction was $169,395; of equipment, $26,473; total cost, $195,868. The same kind of steel rails can now be bought from 30 to 35 per cent less, and other materials are cheaper; so that what then cost about $1,000 per mile to construct could now be done for $700. The rails are of steel, Cawbridge pattern, are 30 feet long, and weigh 30 pounds to the yard. Number of ties used per mile, 2,640. There are two engines—built at the Hinkley Locomotive Works, Boston—each weighing 26,000 pounds, with driving wheels 30 inches in diameter; and their power, considering their small size and weight, is simply surprising, as is shown by the way they conquer steep grades with heavy loads, and force their way with plows through deep snows and huge drifts, by which they are seldom long detained. The two passenger cars (built at the Laconia Car Works, New Hampshire) are each 45 by 6½ feet. Each seats thirty passengers—one person to a seat, there being two rows of seats—is finished in solid mahogany, and nicely upholstered. Between the floorings of each car mineral wool three inches deep renders them fire proof, prevents any cold air from passing, and deadens the noise. These cars are run with little jar or noise on 18 inch wheels, are equipped with the Miller platform and vacuum brakes, are elegant, cozy, pleasant, comfortable, in short, are every way satisfactory, and compare favorably with their more pretentious brethren. The freight cars, some twenty in number, are 26 by 6½ feet, and carry ordinarily a burden of eight tons, although having a capacity of twelve tons. There are also a baggage-mail-express car, a combination car, three hand and three push cars, and a snow plow. Adopting the truism that the best is the cheapest, the company, while avoiding any hint of extravagance, made comfort, utility, durability, and safety a *sine qua non.* All the trains are mixed. They ordinarily take one hour to accomplish the sixteen miles of road, but have been run that distance in thirty-six minutes. The amount of coal required for the round trip—thirty-two miles—is 500 pounds. The heaviest grade (200 feet to the mile) is near the Hiram terminus, and is on a half mile 20 degree curve. There is another curve of 18 degrees, one of 16, one of 12, one of 11, four of 10 each, and a considerable number of less degree.

The aforesaid Central and South American inspection parties learned some, to them, surprising facts in their 40 minutes' ride from Hiram to Bridgton. They learned that the little 26,000 lb. locomotive could draw a well loaded train up a grade 200 ft. to the mile; that it could easily round a 20 deg. curve; that the seeming recklessness of attempting to run a train on rails only two feet apart proved a thoroughly safe performance, so far as any danger of a tip over was concerned, on account of the nearness of the cars to the ground and consequent lowering of the center of gravity; and that the three essentials of safety, speed, and comfort were abundantly secured. A striking test of the capability of the system was made. The visitors were disembarked at the beginning of the 16 deg. curve, and, despite their fears and misgiving when Mansfield, who chaperoned the party, told them the train should round that sharp arc at a speed of 25 miles an hour, the thing was done before their very eyes. No wonder that the optics of Senor Ruiz (Ecuadorian consul at New York and son-in-law of the president of the republic of Ecuador) and those of his fellow travelers dilated with astonishment.

From the report of Treasurer Burnham, of the Bridgton & Saco Railroad, we learn that the total cost of running and maintaining the road for the first year, including taxes, repairs, insurance, salaries, damage and waste, office expenses and all the incidentals, was only $15,248.31. Passengers carried, 12,355; passenger mileage, 173,835. Freight carried, tons, 6,962; freight mileage, 92,926. And the road could easily do double this amount of business at hardly any increase of expense. For further information, letters addressed to J. A. Bennett, superintendent Bridgton & Saco Railroad, Bridgton, Me., will be cheerfully answered.

Our road was built five years ago, and in all this time not a passenger has been injured, not an engine nor car overturned or derailed, not a smash-up of any kind. What better record could be had?

There are four other 2 ft. gauge roads in Maine, the Sandy River, the Monson, the Franklin & Megantic, and another whose name I cannot now recall, varying from 15 to 18 miles in length.

A few words, in conclusion, in regard to the two roads to be built in the southern part of this continent, the possible adoption by which of the plan of the little 2 ft. road away down East drew these emissaries from the South hither. The Central American road is to be built by the Honduras North Coast Railway and Improvement Company, whose president, S. B. McCarnico, lately inspected our road, and will connect the port of Truxillo with Puerto Cortez, in the republic of Honduras, 115 miles long, for the development of the trade in tropical fruits and vegetables, native woods, medicinal plants, minerals, etc., in which that region abounds. The route of the South American road is 110 miles long, and extends from San Lorenzo Bay to Isbarra, about 40 miles from the city of Quito, in Ecuador, the city being the capital of the republic, with a population of 90,000, and located at an elevation of nearly 8,000 ft. above sea level among the Andes mountains. It is the intention to complete the road to Quito, in time, the name of the road being the Pacific & Quito Railway. There is not a railway in the country, most of the traffic being done on the backs of mules, and it is proposed to build this line to help the trade of that country with America.

Waste.

The complete erasure of the word "waste" from the dictionaries, at all events in so far as it has any relation to industrial products, is, if not quite an accomplished fact, undoubtedly becoming more and more imminent; and we may thank the chemists of this generation for teaching us how to recover and utilize innumerable substances which, in their ignorance, our grandfathers threw away. Thirty years ago the manufacturers of iron, gas, and chemicals everywhere neglected all but the prime objects of their industries, whereas to-day, on the system of taking care of the pennies and allowing the pounds to take care of themselves, competition has induced us to regard our legionary by-products as so many integral parts or branches of each enterprise. If the intelligent men who have "gone before," and who were looked upon by their contemporaries as wise in their generation, could by any chance reappear among us, we might conduct them to our gas works, and with a certain pride explain the origin of our sulphate of ammonia, our aniline dyes, and our hundred other extracts from coal tar. From the contemplation of gas we would turn with them to some of our smelters and furnaces, and point to the mineral wool, the cement, the glassware, the pottery, the fire bricks, and the fertilizer, all derived from our furnace slag; and finally, entering a great chemical works, we should show them how the once devastating gases, so fatal to life and vegetation, are no longer sent free into the air, but are condensed and transformed into staple articles of trade, and how by an ingenious and, to them, undreamed of process we extract the precious metals from our exhausted sulphur ores. To their wondering question, "How can these things be?" we might reply that all these marvels result from a modern and enlightened policy, which, in many countries, has fostered every species of research in every branch of science, encouraged great minds to ponder over and gradually unravel the mysteries of nature, and stimulated a general thirsting for that knowledge which, properly applied, must ever ameliorate our condition in this "vale of tears."—*The Age of Steel.*

House Poison.

If the condensed breath collected on the cool window panes of a room where a number of persons have been assembled be burned, a smell as of singed hair will show the presence of organic matter; and if the condensed breath be allowed to remain on the windows for a few days, it will be found, on examination by a microscope, that it is alive with animalcules. The inhalation of air containing such putrescent matter causes untold complaints which might be avoided by circulation of fresh air.—*Philadelphia Bulletin.*

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HYDRAULIC ELEVATORS.

The rudimentary lifts that are familiar to every one, and the simplest of which is a cable passing over a pulley, carrying at one end the load to be raised and acted upon at the other by animal or mechanical power, are

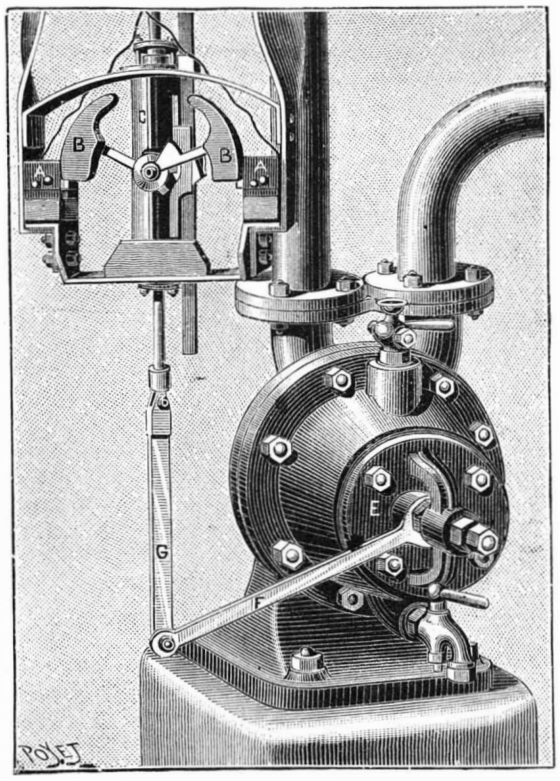

Fig. 1.—THE DISTRIBUTER.
The detail at the left is the hydro-electrical regulator.

the originals of what in our day have taken the name of elevators. For these primitive apparatus there have been substituted hoists provided with cages, the most improved of which carry a safety device designed to hold the cage in case the cable should part. This is the kind adopted in most mines. Safety apparatus are numerous, but the fact must be recognized that they are sometimes wanting. Apparatus constructed on

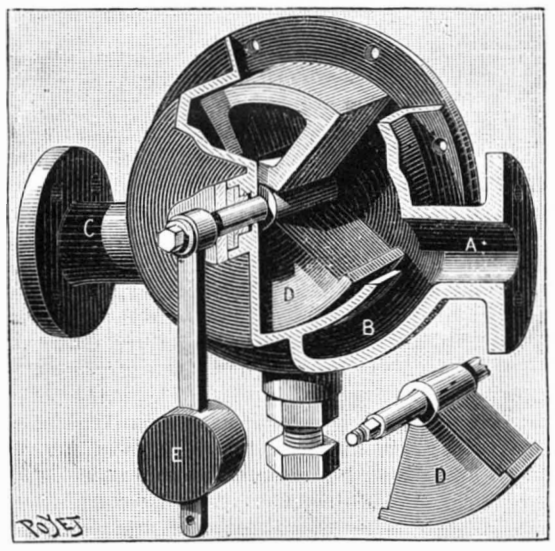

Fig. 2.—APPARATUS FOR REGULATING THE MOTION OF THE ELEVATOR.

these principles are scarcely employed for anything but lifting goods.

It was not till twenty years ago that the idea occurred of replacing chain or cable traction by direct-acting apparatus, in which the weight is lifted in such a way that the cage is always sustained by the column that supports it.

The first type of hydraulic elevator designed to lift persons with security was shown at the Universal Exposition of 1867 by Mr. Leo Edoux.

Every elevator consists of the following parts: (1) Of a car fixed to the extremity of a metallic column forming a piston; (2) of a cast iron cylinder placed in a well of a depth a little greater than the height of the car's travel, and in which moves the column that supports the car; (3) of various maneuvering and safety apparatus that permit of making a pressure of water act upon the piston in order to raise it, and, on the contrary, of suppressing such action, so as to allow the car to descend by its own weight; and (4) of a system of balancing.

The general arrangements of the piston, cylinder, and car are shown in Figs. 3 and 4. Driven wells are lined with cast iron piping, which constitutes the cylinder of the elevator. The pistons, which at first were likewise of cast iron, are now made of steel, and are sometimes inclosed in a cylinder of polished copper. They are composed of steel tubes fixed end to end by internal couplings.

The maneuvering and safety apparatus are quite numerous. We shall give a few examples of them:

The distributer permits of (1) putting the piston cylinder in communication with the water conduit; (2) of intercepting all communication; (3) and of putting the cylinder in communication with the exhaust pipe. Thanks to this apparatus, the car may be made to rise, to stop at any point, and to descend. Fig. 1 shows the arrangement of the Edoux distributer, which consists of a circular slide valve. It is maneuvered in all systems by acting upon a lever, F, by means of a rod, G, that is actuated from the car by means of a rope. At the top and bottom limits of the car's travel the distributer is automatically closed through a contact with tappets fixed to the car and the maneuvering rod, so as to prevent any inattention from causing violent or dangerous shocks at the ends of the car's travel.

Finally, a system of automatically maneuvered bolts permits only that door to be opened opposite which the car has stopped.

It has been found necessary, too, to have an apparatus for automatically regulating the velocity of the car. In fact, as the section of the piston is calculated for a medium pressure, and as the real pressure may undergo great variations, and, on another hand, as the weight of the passengers must also vary, very variable velocities might result from the addition of these two causes, and such velocities might in certain cases become dangerous. The regulator used is shown in Fig. 2. It consists of a valve, D, placed in the conduit. This valve is provided with a counterpoise, E, calculated in such a way that the lever at the extremity of which it is fixed remains in a vertical position for the proper velocity of water, either in one direction or the other; that is to say, for the ascent or descent. The valve closes the aperture, A or C, and, as the quantity of water distributed is diminished, the velocity of the elevator is regulated. The passage of water through the conduit, B, is permanent, and in this way such shocks as might result from the abrupt and entire closing of the orifice by the valve are prevented.

It has occurred quite recently to Mr. Edoux to add to his apparatus a safety device against the effects of air in elevators. The necessity of this was recognized from the following circumstances:

During the repairs of all kinds to the water mains of cities, the pipes become empty. When the work is finished the water is turned on, and the air that has taken the place of the water may be strongly compressed in the conduit. If, at such a moment, the distributer of an elevator be opened, the compressed air may act violently upon the piston and give the apparatus an ascensional motion that cannot be controlled by the regulating valve, since the latter is arranged for operating under the action of water. The consequence of so sudden an ascent or descent may prove fatal if the passenger, losing his coolness, commits the imprudence of leaving the car while in motion.

To prevent such effects, a closed metallic reservoir, of a capacity a little greater than that of the piston, is interposed between the distributer and the regulating valve with which they are put in communication. The pipe from the distributer stops at the top of the reservoir, and the one going to the valve descends to the bottom. Under such circumstances, if the conduit is full of air and the distributer be opened, the water in the reservoir will be submitted to the action of the compressed air, and the piston will rise at a normal velocity, the entrance of water being moderated by the regulating valve. Upon the descent, the water in the cylinder will again fill the reservoir, and the air, giving way to the water, will escape freely into the atmosphere through the distributer.

Various systems of balancing have been adopted by

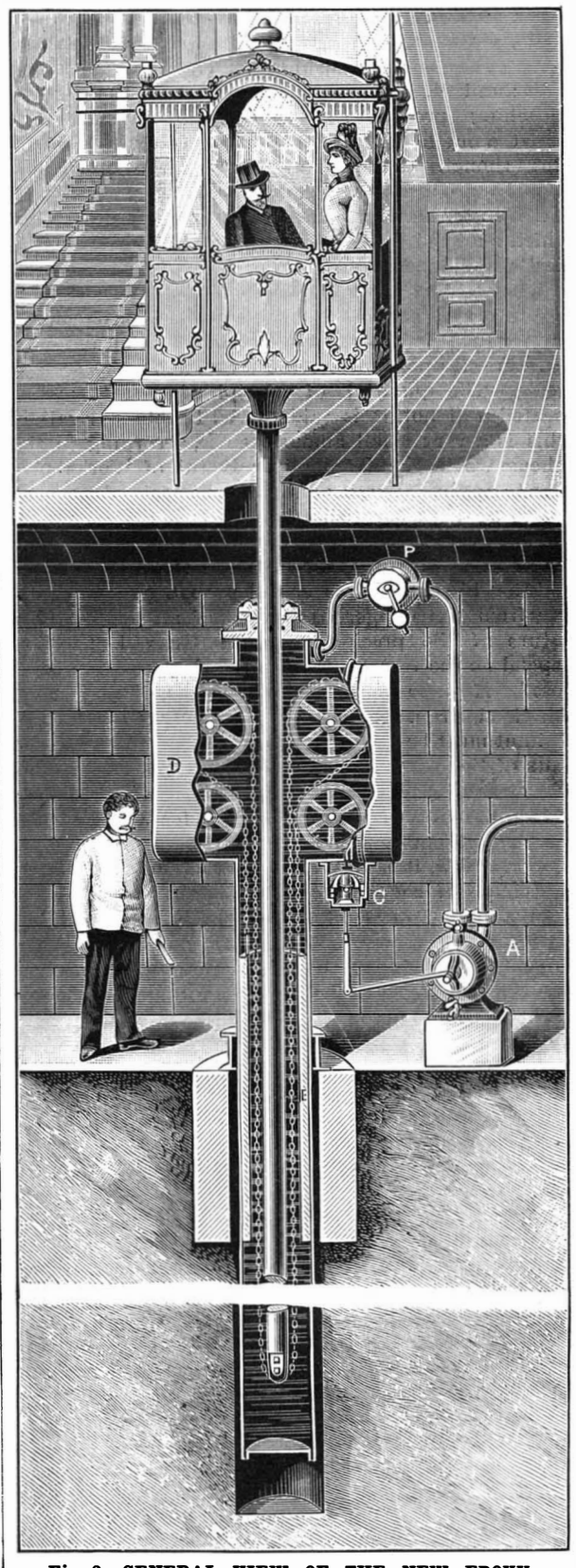

Fig. 3.—GENERAL VIEW OF THE NEW EDOUX ELEVATOR.

constructors. A rational system must consist of two parts, one fixed and the other variable, by reason of the fact that the piston varies in weight, according as it is plunging into the water or emerging from it. Up to recent times this result has been obtained mathematically in a very simple way, in Mr. Edoux's apparatus (Fig. 4, No. 1), by means of chains fixed to the car, passing over pulleys, P, at the upper part of the building, and carrying counterpoises, C. When the elevator is rising, these counterpoises and the chains descend, and, as a general thing, within hollow cast iron columns, that serve at the same time as a guide to the car.

With chains whose weight is proportioned to the volume of the piston, the latter is balanced. Let us, in fact, suppose the elevator at the center of its travel (Fig. 4, No. 1), then, the two lengths of chain, B B', counterbalancing each other, the counterpoise, C, in order to produce an equilibrium, will have to represent the weight of the car, a, and of the piston half immersed in water. If the piston rises a certain distance, a meter for example, it will increase in weight, p, equal to the

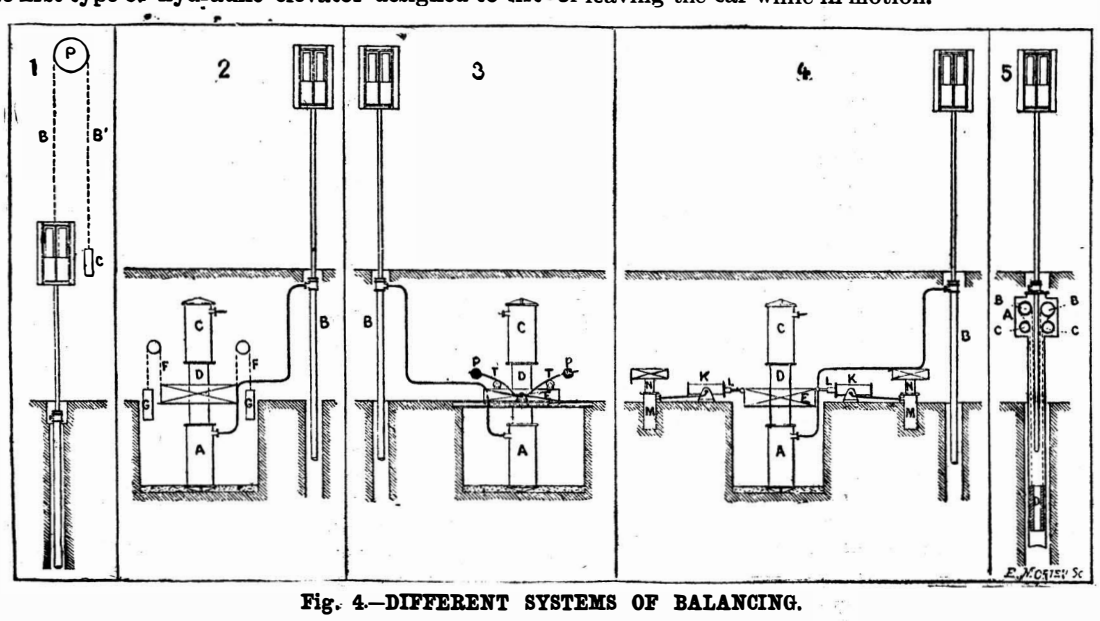

Fig. 4.—DIFFERENT SYSTEMS OF BALANCING.
1. Original Edoux system. 2, 3, and 4. Heurtebise system. 5. New Edoux system.

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volume of water that has taken its place in the cylinder. The part of the chain to the right of the counterpoise will have become two meters longer than that near the car. In order that an equilibrium may be maintained, the two meters of chain must equal the weight, p, and the meter of chain must therefore weigh $\frac{p}{2}$.

The conditions of a permanent equilibrium in all positions are, therefore, the following: (1) Counterpoise equal to the weight of the car and semi-immersed piston; (2) balancing chain, weighing to the meter half of the weight of the volume of water corresponding to a displacement of one meter of the piston.

This system of overhead balancing presents certain inconveniences, and there are sometimes difficulties in the way of installing transmissions above. Various other arrangements have been devised, and, to cite only what has been done in France, we may mention the Heurtebise system (Fig. 4, Nos. 2, 3, and 4). This system is based upon the use of a compensator formed of two cylinders, A and C, one of which receives the pressure of the water, while the other communicates with the well of the elevator. In these cylinders moves one piston in common, D, whose weight compensates that of the car and the column—the whole constituting a sort of hydrostatic balance.

It will be remarked that if the travel of the piston and compensator are in the ratio of 1 to 10, the latter will have to have a weight and section ten times that of the former. So the trouble with this system is the difficulty of establishing and maneuvering so large masses. Besides, the compensator balances nothing but the invariable part of the dead weight. The arrangements adopted for counterbalancing the variable part of the load have farther complicated the apparatus.

The successive arrangements to which recourse has been had are shown in Fig. 4 (Nos. 2, 3, and 4). The first consists in the use of chains, F, and counterpoises, G, which are huge by reason of the ratio of the travels. This arrangement operates under the same conditions as the balancing by counterpoised chains shown in Fig. 4 (No. 1). An endeavor has been made to attain the end by the action on the compensator of counterpoises, P, fixed to the extremities of large levers, T, whose variable inclination, connected with the motions of the compensator, vary the action exerted upon it (Fig. 4, No. 3).

Finally, an application has been made of oscillating cylinders (Fig. 4, No. 4). The cylinders, K, being in a horizontal position when the elevator is in the center of its travel, the action of the piston is null, but if they are revolving on their axes in one direction or the other, the compensator will receive a vertical thrust from them whose energy will increase in a certain proportion in measure as they depart from a horizontal position. However, it must be remarked that, to the detriment of the useful effect, while the modification of the weight of the piston is always equal per unit of distance traveled, the same is not the case with the vertical component of oscillating pistons. These latter must, besides, be provided with special accumulators, M, which, although they prevent variations in the pressure of water conduits, and diminish the surface of the pistons, are nevertheless a still further complication of the apparatus.

Mr. Abel Pifre has recently replaced the apparatus for balancing dead weights by a float that receives a thrust which counterbalances the useless weights. This float is placed at the lower extremity of the piston supporting the car. This is one of the simplest of solutions, but no regard is paid to the variations in the weight of the piston.

From what precedes, it will be seen that the system of balancing by weights and chains is the completest and least complicated. Originally, when the pistons were of cast iron, it was even the only one applicable, and it is only as a consequence of the progress of metallurgy that the system of balancing beneath has become possible.

Mr. Edoux has adopted a new arrangement of this kind without in any way modifying the principle of his first one. The chains and counterpoise play exactly the same role as before, the transmitting parts alone being shifted. In this new arrangement (Fig. 3, and Fig. 4, No. 5), the cylinder terminates at the top in a tight metallic box of small size, in which are inclosed all the transmitting and guide pulleys. A chain passing beneath the piston winds around these pulleys and supports an annular counterpoise through which the piston passes, and which runs up and down the entire length of the cylinder. In determining the weight of the counterpoise and chain, regard is evidently paid to the influence of the liquid in which they move—a circumstance that is an advantage, for, in fact, it involves an increase in weight per meter of the chain, and, as the weight that the latter has to support remains the same, there results a further guarantee of safety. Moreover, in this system, a breakage cannot affect the safety of the passengers, nor even occasion any material damage.

Mr. Edoux has also introduced an improvement into the distributer, which he maneuvers through a small hydro-electric apparatus (Fig. 1). This auxiliary motor is a multiplier of force.

The maneuvering lever of the distributer is connected with the rod of a small hydraulic double-acting piston, C, which is provided at the center with a distributing cock. Four pipes end in this, one leading water under pressure, two carrying the water to the extremities of the cylinder, and one allowing it to escape. The cock is maneuvered through levers which carry, each of them separately, two counterpoises, B. At rest, these levers are raised, and the counterpoises bear against two spring tappets which are set free by passing an electric current into the electros, A. The levers are loose under the rod of the cock, and are maneuvered through the intermedium of a disk keyed upon the axis. When one of the catches is freed, the corresponding weight falls, its rod revolves and carries along the disk keyed to the axis; the cock opens, and the water acts against one of the faces of the small piston whose rod maneuvers the distributer.

The counterpoises are raised and put back in place automatically, by means of a vertical bar connected with the piston rod, whose motion it follows.

In the car, and at each landing, there are two contact buttons, by means of which one or the other of the electros is made to act. In this way, the ascending or descending motion of the car is arrested. Fig. 3 shows, in one group in common, the latest improvements introduced into the elevators just described.—*La Nature.*

PROF. ASA GRAY.

A Monkey's Trick.

A few days since, for the third or fourth time within a year, a monkey figured as an incendiary, firing the well known steam yacht Norma, lying at a wharf in New York. It seems to have gone about the job with the greatest deliberation, too—gnawed through the ropes with which it was tied up, cleared out a match safe in the cabin, and then started the blaze in a place which only a monkey would have thought of, between the deck and the ceiling of the coal bunkers. It took the crew all night to locate and put out the fire, which was filling the boat with smoke, the monkey, whose part in the affair was established by indisputable circumstantial evidence, being afterward found on an eccentric bar in the engine room, quietly grinning over the rumpus which it had raised. *Fire and Water* suggests that monkey risks will be next heard of in insurance circles if this kind of thing keeps up.

PROF. ASA GRAY.

The great botanist who did so much for American science, and who contributed as much or more than any other scientist of this country to its reputation abroad, died at his home in Cambridge, Mass., on the evening of January 30, 1888. For several days he was in a semi-conscious state, from which he never rallied. For over a month he had been helpless from paralysis.

He was born in Paris, Oneida County, N. Y., on November 18, 1810. He studied medicine, graduating from Fairfield Medical College in 1831. He did not practice his profession, but devoted himself to botany. A few years later he received the appointment to the position of botanist to the Wilkes Exploring Expedition. This was about 1835. But as delay after delay occurred he became weary of waiting, and resigned the position. In the period of waiting he began work upon Torrey and Gray's "Flora of North America," whose first volume appeared in 1840.

The chair of botany in the University of Michigan was offered to him, which he accepted on condition that he be allowed a year of study in Europe. He was one of the first professors appointed to a chair in the young college which has since acquired a high standing among the country's educational institutes. He visited Europe, carrying with him the commission to purchase a library for the college. He selected a nucleus for the collection of books with great judgment. It is said that the collection thus selected is still looked upon with great pride by the university. He never entered upon the duties of the position of professor there; but at its semi-centennial celebration last summer the university conferred upon him the degree of LL.D.

His year in Europe he devoted to the study of the herbaria. In these he found many examples collected in the early expeditions to America. Thus his life work was commenced in the study of these old type specimens of North American flora. On his return, he resumed work upon the flora, the second volume of which appeared in 1845. Three years earlier, he began his long service in Harvard College, accepting, in 1842, the newly established Fisher Professorship of Natural History. He died while still an occupant of this chair, though relieved from the duty of teaching and care of the botanic garden in 1872.

The herbarium under his charge acquired great dimensions, and became of immense value. He kept up his literary pursuits. His great work was the study of the North American flora, begun about fifty years ago. About 1871, this took the form of a work entitled "Synoptical Flora of the United States." It is not yet finished. Besides this, he wrote many monographs and special studies. In 1854, his work on the "Botany of the Wilkes Expedition" appeared. In 1859, he published his work on the "Relations of the Japanese Flora to those of North America." This work, he thought, did more to make him known in the old world than any other single production. His educational manuals attained an immense success, and it is not saying too much to affirm that the botanists of this continent have been brought up upon the pabulum supplied in them.

His work on the Japanese flora tended toward evolution, and he was one of Darwin's most esteemed friends and powerful advocates in this country. At the same time he never could find in natural selection a satisfactory cause for the law and order he beheld so clearly in the world. Like Clerk Maxwell, he found it an insufficient explanation, and back of it recognized the existence of a first cause. His religious and scientific beliefs are best summarized in his own words:

"I am scientifically, and in my own fashion, a Darwinian, philosophically a convinced theist, and religiously an accepter of the 'creed commonly known as the Nicene,' as the exponent of the Christian faith." His reasons for this position were fully given in a short course of lectures before the Theological School of Yale (1880).

He wrote many reviews and other papers for the journals of the day. He was one of the regular contributors to the *Nation*, of this city. He was an associate editor of the *American Journal of Science and Arts*. In the latter paper he published annually the necrology of the botanists who had died during the year. On his writing table he left the unfinished necrology for 1887.

ACCORDING to native journals, Japan can boast of a phenomenal giantess. Though only twelve years and five months of age, she is said to stand eight feet high and to weigh over two hundred and seventy pounds; her hands measure over nine inches in length, and her feet fifteen inches.

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Running Locomotives with Natural Gas.

For some time, it seems, experiments have been quietly conducted by Gen. Supt. W. W. Worthington and the General Master Mechanic of the Fort Wayne, Cincinnati & Louisville road, with a view to the transportation of natural gas in tanks, for use in heating and lighting cars and for fuel in the fire box of the locomotive.

The experiments have been successful enough to warrant the hope that the time is soon to come when the public will be able to ride on smokeless and cinderless cars, and where the entire heat, light, and power come from natural gas. The idea at the base of the experiments was that the pressure that comes from the depths of the earth might force the gas in a condensed form into wrought iron or steel receptacles, which could be sealed up and carried any distance, then attached to pipes and used in the ordinary manner. A special to the *Chicago Tribune* says of it:

The first trial was made at Montpelier, Ind., where there are two strong gas wells. A wrought iron cylinder, 18 feet long and 2 feet in diameter, with heavy ends screwed in, was attached to the biggest well. The cylinder had been subjected to careful and scientific tests at the shops, and was provided with gauges to register the pressure. This well has a rock pressure of 450 pounds to the square inch, and when it was turned on, the gauge on the cylinder fairly danced round, and in a minute almost came to a standstill, showing the cylin der was full and would register no more. The cylinder was then hoisted into a freight car and brought to Fort Wayne. Here it was taken into the company's shops and attached to the usual natural gas burning apparatus, with a "regulator" that controlled the enormous pressure under which the gas had been forced into the cylinder, so that it flowed out in a steady, regular current. This "regulator" was manufactured at Pittsburg, Pa., and is in use, it is said, wherever natural gas is used; and when the gas flows through it, it reduces the pressure from 450 pounds to the square inch, or whatever it may be, to 1½ ounces, at which pressure natural gas is burned. The gauge showed that the gas in the cylinder had lost but little of its pressure, and it supplied light to the gas burners in the shops for several hours, besides heating one large stove and one forge.

The company, being satisfied with the tests made that gas could be transported and used in this manner, are making preparations to test its practicability for use on the road. For this a trial tank car of the shape and size of those used by the Standard Oil and various tank line companies of the country is being built. It will be of steel sections screwed together and banded with wrought iron welded on at the joints, so as to stand the great pressure. This car will be hauled just back of the tender, which will only be used to carry water, and a pipe from it will lead through the regulator placed on the tender to the fire box of the locomotive. Its capacity will be equal to as many thousand cubic feet of gas as will represent enough tons of coal to make the entire trip over the road. At different stations along the line, arrangements will be made for tapping the wells and filling the tank car at any time it runs low.

It is almost impossible to estimate the enormous saving that will follow this use of natural gas for fuel. It is said that the Lake Erie & Western Railway, which runs through the great gas fields of Ohio and Indiana from Findlay, O., to Tipton, Ind., has a machinist there watching the experiments, which may be of colossal value to that road. The General Master Mechanic and Master of Transportation of the Pennsylvania lines west of Pittsburg are also said to be there in the interest of their roads, and the experiments are being watched by the railway world with great interest.—*Amer. Engineer.*

[The pressure above indicated, 450 lb. per square inch, is equal to 30 atmospheres, or the compression of 30 cubic feet of gas into the space of one cubic foot. The experimental cylinder above mentioned, at 450 lb. pressure, was capable of carrying close on to 1,700 cubic feet of gas.—ED. S. A.]

A THEORY of obesity, proposed by M. Leven recently, and described before the Societe de Biologie, is that it is a nervous disorder, and to be treated by avoidance of mental and physical fatigue, and a diet of eggs, soup, milk, rice, and potatoes.

A REMARKABLE RAILWAY WRECK.

The wreck of two passenger trains on the Rochester (single track) division of the New York, Lake Erie, and Western Railway, one mile east of Avoca, on Tuesday, the 17th of January, was an interesting one, aside from the sad event connected therewith. The train from Rochester, No. 18, was drawn by engine 260, Frank H. Maynard engineer, and the train from Elmira, No. 107, by engine 69, Frank Marsh engineer. The blame has been placed upon the train dispatcher, but it would seem to be as just to attribute the accident to the system of train management. On the Pennsylvania Company's railways what is known as the "double order system" is in vogue. The train dispatcher will call two stations nearest the approaching trains, and issue an order to the engineers and conductors of the two trains to be affected. For instance: "Conductor D and engineer E, train 39, will meet and pass conductor F and engineer G, train 40, at York." The operators will each repeat the order back to the dispatcher and wait for his "O. K." before allowing the trains to proceed. On the New York, Lake Erie, and Western a separate order is issued for each train, repeated, and "O. K.'d," as common to all systems.

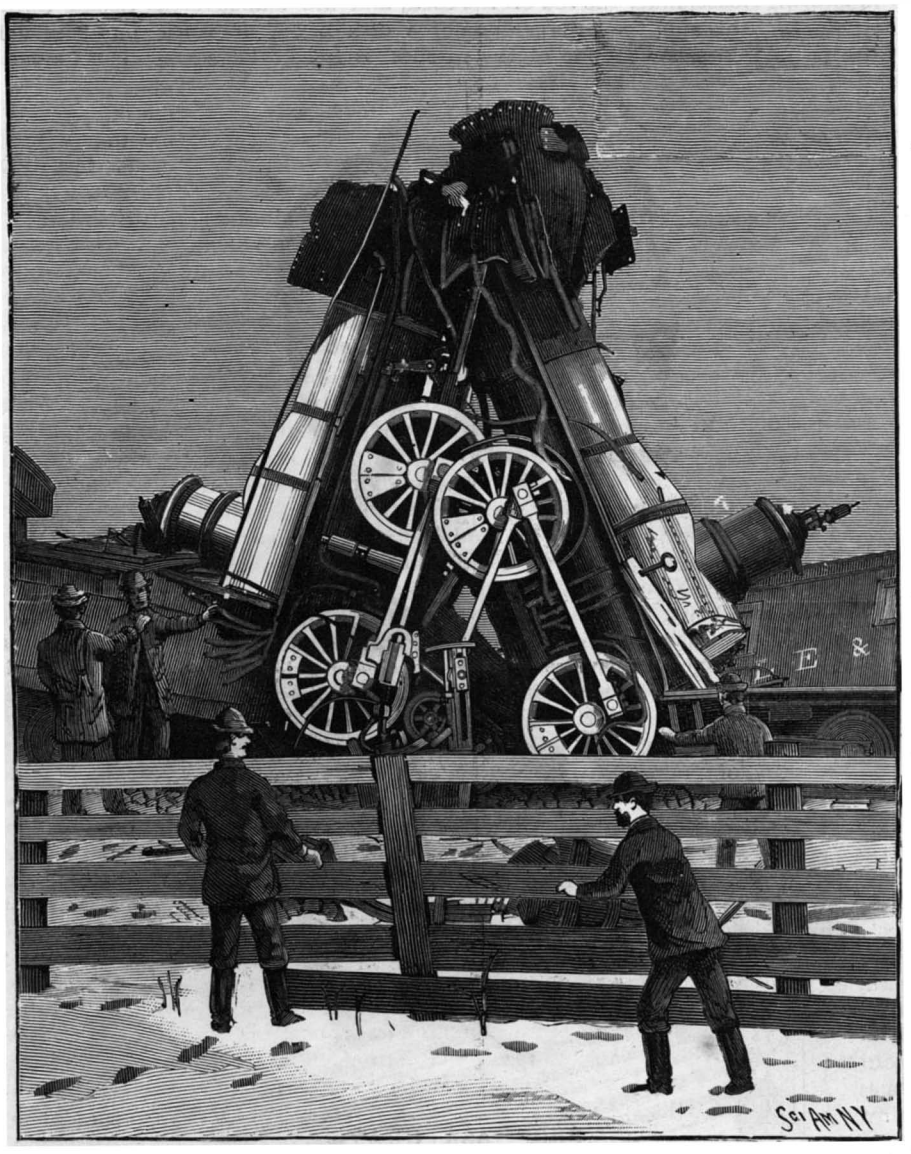
The confusion leading to the wreck near Avoca seems to have arisen from train 18 running behind train 107 instead of ahead, as usual when on time, and the train orders for the two getting confounded in the mind of the dispatcher. The dispatcher discovered his error, it is claimed, almost immediately, but on calling Avoca could get no response, as the operator had left his instrument to attend to the duties of baggageman or express agent, it being the custom at small stations to place the several titles and duties upon one man. Train 18 was fifteen minutes late, and Engineer Maynard remarked to his fireman, Frank Marsh, Jr., that he would have to "let her out." Both trains make high speed between stations. They met on a sharp curve. Engineer Marsh saw the down-coming train in time to pull the air brake lever and jump, his fireman having preceded him. Engineer Maynard was on the outside of the curve, and presumably did not have as good a view of the track ahead, a bit of woods with thick underbrush bordering the railway on the inside of the curve hiding the track ahead.

The curve is a short one, and on either side lies a mile or more of straight track, so that ten seconds difference in the time of one of the trains would undoubtedly have prevented the accident. Maynard's fireman happened to look ahead from his side of the cab at the right instant, shouted, "There they are, Frank," and leaped just as the trains came together. Maynard pulled the air brake lever just in time to set the brakes. It is apparent, also, that he put his head out of the cab window, as if to escape being crushed, but the cab was so broken that the hard wood frame acted like a huge pair of shears, cutting his head completely from his shoulders, so that it fell by the side of the track upon the snow. It is apparent that the air brakes saved all others on the trains from instant death. Nearly every one received a bruise of some kind, but none of them serious. It is seldom that two engines more completely wrecked are seen. Equal to each other in every particular, they met and stood erect as if to wrestle, their driving wheels wedged together, and machinery almost completely stripped from the boilers. The accompanying cut is from a photograph taken within an hour after the collision, by I. F. Moore, of Avoca. It was probably the most picturesque wreck, so far as the locomotives are concerned, that has occurred in years.

The unlucky incident is worthy the study of railroad managers. The writer is informed that two men, working twelve hours each, do the train dispatching on the division where the accident occurred, and he knows personally of dispatchers who work eight hours without cessation at their instruments in handling the many trains of a trunk line in New York State, besides doing a large amount of other telegraphic work, and then completing a day's work of eleven or twelve hours, often more, in making out the daily reports. This is done seven days in the week, and vacations come very rarely. Train management requires such a clear head that it cannot be done efficiently with the dispatcher constantly overworked.

A law limiting the hours of office work for a train dispatcher to eight would certainly insure greater safety to the public, and, it would seem, enable the dispatcher to handle his multitude of trains with greater facility. Further legislation to secure the constant attention of an operator at his instrument, undiverted by the duties of ticket agent, baggage or express agent, also seems advisable. Accidents so destroy public confidence in the safety of a railway that not only destroyed life and property, but diminished patronage, must be counted in footing up the loss.

The coroner's jury which investigated the cause of the death of Engineer Maynard found that an error in the train dispatcher's office at Rochester. The jury also found: "The company required Train Dispatcher Sauerbier to keep an account of and report daily all cars ordered, received, and on hand at date on the divisions of which he had supervision. The said divisions comprised about 170 miles of track, over which 36 trains passed daily. His duties as dispatcher required him to serve continuously twelve hours out of the twenty-four. We recommend that the railroad company employ a person other than the dispatcher to keep and make such car reports. We further find that said dispatcher had more duties to perform at the time of making such error than should have been required."



A REMARKABLE RAILWAY WRECK—NEW YORK, LAKE ERIE, AND WESTERN R.R.

Bricklayers in Frosty Weather.

A writer in the *Building News* (London), referring to a report issued from the Foreign Office, which he claims contained nothing but what every practical bricklayer in England already knows, offers the following substitute, which he thinks every bricklayer does not know:

Mortar made in the following manner will stand if used in almost all sorts of weather: One bushel of unslaked lime, three bushels of sharp sand; mix 1 lb. of alum with one pint of linseed oil, and thoroughly mix this with the mortar when making it, and use hot. The alum will counteract the action of the frost on the mortar.

Tests for Swords and Cutlasses.

In order to more completely insure the good quality of the swords and cutlasses issued to the British navy, orders have been given for the following tests to be applied to a large number of cutlasses which are to be repointed and reduced to a uniform blade length of 27 inches. First the sword is to be subjected to a direct vertical pressure on the hilt in a machine specially constructed for the purpose, and it is required to stand a pressure of 40 lb. without deviating from the straight line.

Then additional vertical pressure is to be applied in the machine until the sword is bent so that the distance from point to hilt is reduced 3 inches. Finally the blade has to be bent round a suitable curved block, so that every portion of it partakes of the bend, the distance from point to hilt being reduced 2½ inches. The sword also has to be struck with moderate force, back and edge, on a block of oak to test the soundness of the hilt.

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The Lick Observatory Astronomers.

At a recent meeting of the Board of Regents of the University of California, the special committee appointed to consider the resolution accepting the resignation of Edward S. Holden as president of the university, and resolutions appointing the director of and the astronomers in the Lick Observatory, and resolutions appointing a secretary and librarian, and also a machinist, a laborer, and a janitor, reported through A. L. Rhodes.

The resolutions, as adopted, are as follows:

That the resignation of Edward S. Holden as president of the university be accepted.

That Edward S. Holden be, and he hereby is, appointed as director and astronomer of the Lick Observatory, subject to the control of the Board of Regents.

That S. W. Burnham, A.M., be, and he hereby is, appointed as astronomer, with a salary of $3,000 per annum. That J. M. Schaeberle, A.M., be, and hereby is, appointed astronomer with a salary of $2,000 per annum.

That J. E. Keeler, A.B., be, and he hereby is, appointed astronomer with a salary of $1,400 per annum.

That E. E. Barnard be appointed astronomer at $1,200 per annum.

That the following be appointed: John McDonald, machinist, $700 per annum; Chris. McGuire, laborer, $720; and Charles Harcort, janitor, $720.

That a secretary and librarian be appointed.

That a committee of three regents be appointed, who shall be authorized to make necessary arrangements for the conveyance and delivery of the Lick Observatory, the lands upon which it stands, and the property and money in the hands of the Lick trustees, which are required by the deed of trust to be turned over and delivered to the Board of Regents.

The committee to which was referred the orders of the board relating to the Lick Observatory submitted the following report, which was adopted:

That the official designation of the Lick Observatory and telescope on Mount Hamilton shall be "The Lick Astronomical Department of the University of California." The balance of the $700,000 given by Mr. Lick for the foundation and endowment of the observatory, and such other sums as may from time to time be given, shall be known as the Endowment Fund of the Lick Astronomical Department of the University of California. That students who are graduates of the university and colleges of like standing shall be received at the observatory as students to pursue a higher course of astronomy.

The resignation of the president of the university is to take effect when the observatory is formally turned over to the regents. Prof. Holden's salary is $5,000 per annum.

Calcareous Water.

The Weavers' School of Aix-la-Chapelle writes as follows to the *Centralblatt f. d. Textil-Industrie:*

"The reply by another correspondent published by you compels us to again take up the subject. The writer advises to soften the water by an addition of milk of lime. We, however, would most seriously warn parties against doing it. It is true that carbonate of lime in water can be precipitated by milk of lime, because the excess of carbonic acid, without which the lime cannot remain in solution, becomes fixed. But the vital question in the matter is, How much milk of lime is to be added? The operator would have to know to a nicety how much carbonate of lime is contained in the water, and how much caustic lime is contained in the milk of lime.

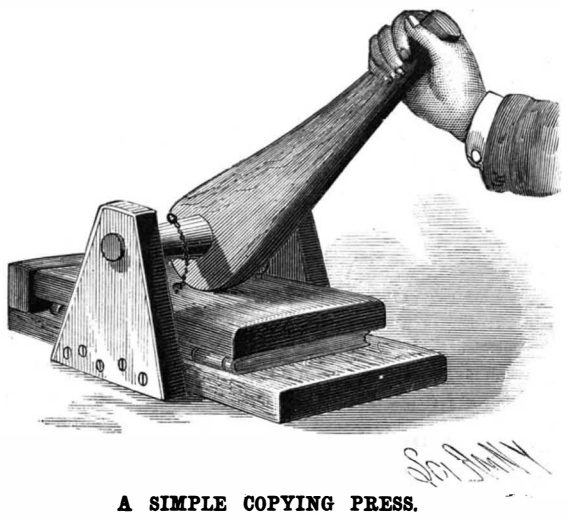
"But can this be established with precision in every case? To be added to this difficulty is the fact that milk of lime cannot be kept in the open air, because the caustic lime will change into carbonate of lime, whereby the entire solution loses its strength. The greatest danger, however, is that the operator will add too much milk of lime to the water, which addition, in place of making the latter softer, will make it very hard; and if he uses it at once, when the reaction of the water containing an excess of milk of lime is still alkaline, he may experience a number of undesirable accidents, both in washing and dyeing.

"The main point of the question, however, has not been touched upon at all by the respondent. The hardness of the water is most generally due, not to carbonate of lime, but to sulphate of lime (gypsum). Can this also be precipitated with milk of lime? As we stated in our answer, nothing is good except the addition of solution of soda to the boiling water, which process has time and again shown its efficacy, and has therefore stood the test of experience. The gypsum is thereby at once converted into carbonate of lime, and since all excess of carbonic acid has been expelled by boiling, it is precipitated at once."

MOISTURE-PROOF glue is made by dissolving 16 oz. of glue in 3 pints of skim milk. If a still stronger glue be wanted, add powdered lime.

A SIMPLE COPYING PRESS.

We illustrate in the present issue a very simply constructed copying press. Its construction is so clear that little description is required. It was devised by Mr. O'Rourke, one of the constructing engineers of the Poughkeepsie bridge. A wooden cam rotates in suitable bearings, and when turned, by pulling forward the lever, forces the platen downward upon the copying book. When the lever is pushed backward, it not only relieves the platen from pressure, but also raises it. This it does by a short chain or wire attachment which

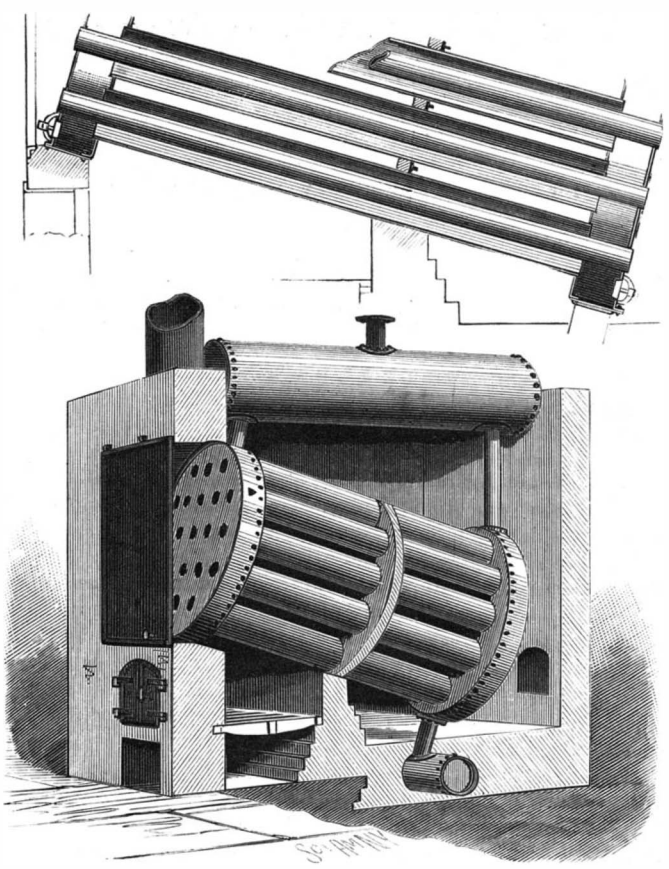


A SIMPLE COPYING PRESS.

is wound around the axle or drum to which the cam is attached. It is all made of wood, except as regards the nails or bolts and the chain.

AN IMPROVED STEAM BOILER.

A steam boiler designed to give a maximum amount of heating surface, in order that steam can be generated with the smallest possible amount of fuel, has been patented by Mr. Oliver H. Gentry, of Opelousas, La., and is represented in the accompanying illustration. The boiler is preferably set at an inclination, as shown in the view in perspective, and each of its ends consists of a circular drum, through which extend flue tubes, passing through both front and rear drums, these flue tubes being surrounded by water tubes, opening into the interior water spaces of the drums. A mud drum is arranged transversely under the lower side of the rear drum, with which it communicates through a short vertical pipe, and a steam drum arranged horizontally over the boiler is in communication with the top portion of the water drums at both ends by vertical pipes. The tubes are expanded in the tube sheets, and the setting shown is designed to represent about the proper angle to insure the best circulation. When the boiler is filled, the water in the drums and tubes entirely surrounds the flues, and the products of combustion, after circulating around the tubes until they reach the rear drum, are deflected downward to its rear side,



GENTRY'S STEAM BOILER.

thence passing forward through the flues to the stack at the front, up which they escape.

IODIZED starch has been recommended as a substitute for iodoform, on the ground that iodoform owes its power to the iodine given off from it.

A New Departure in Brazing and Welding.

Mr. Thomas Fletcher, the well known gas engineer, writes to the *Journal of the Society of Arts*, London, as follows:

"The cheapening of oxygen by Brin's process of manufacture has put into the hands of metal workers a new power. I have recently made a few experiments with the compressed oxygen and coal gas, and found that with ½ inch gas supply a joint could be brazed in a 2 inch wrought iron pipe in about one minute, the heat being very short, the redness not extending over 1 inch on each side of the joint. The appearance of the surface after brazing led me to experiment further with welding—a process which is not possible with ordinary coal gas and air, owing to the formation of magnetic oxide on the surfaces. Contrary to my expectation, a good weld was obtained on an iron wire ⅛ inch diameter with a very small blowpipe, having an air jet about $\frac{1}{32}$ inch diameter.

"This matter requires to be taken up and tried on a large scale for such work as welding boiler plates, which, it appears to me, can be done perfectly with far less trouble than would be required to braze an ordinary joint. The great advantage of this would be that the boilers would require no handling, but could be welded with an ordinary large blowpipe in position, and with about one-tenth the labor at present necessary. The cost of the oxygen is trifling, and it is evident from the results obtained in brazing that the consumption of gas would be considerably less than one-fourth that necessary with an air blast, irrespective of the fact that welding is possible with an oxygen blast, whereas it is not possible if air is used. The surface of iron heated to welding heat by this means comes out singularly clean and free from scale, and a small bottle of compressed oxygen with a blowpipe and a moderate gas supply would make the repairs of machinery, boilers, brewing coppers, and other unwieldy apparatus a very simple matter. The trouble and difficulty of making good boiler crowns, which so frequently come down, would be very small indeed when the workman has an unlimited source of heat at command, under perfect and instant control."

The Manufacture of Aluminum.

Works for the manufacture of sodium by the Castner process and its conversion into aluminum under the process of Mr. James Webster are now being erected by the Aluminum Company, of St. Mary Axe, London, at Oldbury, near Birmingham, which, it is expected, will bring an important trade to the district. The process of sodium production, which has been invented by Mr. H. Y. Castner, New York, has already been described.

By this process the cost of sodium is reduced from 4s. to 1s. per lb., and of aluminum from 60s. to less than 20s. per lb. The aluminum is produced in pigs of 4 lb. weight. The same sized pig of the alloy known as aluminum bronze, copper and aluminum, weighs 12 lb. —a fact which strongly illustrates the relative lightness of aluminum. Its value is further increased by its tensile strength and its non-liability to oxidize. It is obvious that the manufacture of this reliable metal upon an extensive commercial scale at a much lower cost than hitherto involves important consequences to English metallurgical industry.

The new works at Oldbury occupy 4½ acres of ground, and they will be capable of producing £300 worth of aluminum per day. The number of men to be employed is not yet definitely decided upon, and in aluminum manufacture extent of production is indicated more by the amount of machinery plant than the number of workmen engaged. At Oldbury there will be four furnaces, each with five chambers, for the manufacture of sodium, and a number of other furnaces which have yet to be erected will be used for making chloride of aluminum and the aluminum itself. The furnaces will be fired by eight Wilson gas producers. The gas from these will be carried to the furnaces through pipes, and as there will be a separate valve to each furnace, the supply of heat will be regulated without difficulty. All the coal consumed at the works will be brought by canal. There is a special creek running into the works. On the other side of the works runs the line of the Great Western Railway Company. Just opposite the works, on the other side of the canal, is a manufactory of chemicals, and from this establishment will come the soda and certain of the other materials used in the production of aluminum. At the Solihull works of the company the co-metal is already being turned out, and is being received with considerable favor. Many metal-working firms are using an alloy of aluminum and copper—90 per cent of the latter to 10 per cent of the former—and express much satisfaction with its qualities. The new works are being rapidly erected, and it is expected that full work will be begun in March. One of the chimneys, which is 150 feet high, with an internal diameter of 6 feet, is already completed; and another, 180 feet in height and 8 feet across at the top, is already about half built.—*Iron.*

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Winter Care of Poultry in a Nutshell.

I notice that much interest is shown in the matter of winter laying of hens. As I have had good success in that line this year, your readers may be interested to know what has been done.

1. Stock. My brood consists of eight pure Brahma hens, two years old; ten Plymouth Rocks, and ten of a cross between a pure Brown Leghorn cockerel and White Brahma hens, of which twelve are eight and the balance six months old; one Plymouth Rock and one Brown Leghorn cockerel.

2. Feed. First thing in the morning a medium feed of three parts wheat and one of corn. In the middle of the morning the table scraps from breakfast warmed up and a tablespoonful of concentrated chicken feed from the grocer's stirred in. In the middle of the afternoon the dinner scraps are fed as they run. We give no feed at night. Water given in an open iron baking pan every morning.

3. House. Moderate size, wood floor, two small windows, floor raised a foot from the ground, shelter shed on one side. No artificial heat. Well ventilated.

4. The Run. Since the middle of October they have been free to forage in lawn and garden.

5. General Care. House cleaned weekly in summer, and once a month white-washed with carbolic acid in *very thin* lime wash, fresh hay in nests and roosts rubbed with kerosene. The run spaded up twice in the year.

6. Results. But two chickens or hens lost from sickness in two years. Pullets began to lay at six months of age, the cross-bred laying first—nine to twelve eggs a day through December and January, thus far.

Essex, Conn. E. W. W.

—*Rural New-Yorker.*

The Future of Great Cities.

At Toynbee Hall, London, a lecture was lately delivered upon the subject of the future of great cities by Mr. Frederic Harrison. London, he said, presented the hugest assemblage of buildings ever piled upon the earth, and for three centuries men had been thinking how its enormous growth could be dealt with. In this century the population of London had increased fourfold and its area about fifteenfold. Every year some 70,000 fresh souls were added to the population by immigration or birth. Every ten years there was added to London by immigration alone the population of a city as large as Lisbon or Bristol, and by immigration and birth together there was added a population as large as that of St. Petersburg or Vienna. The abnormal and spasmodic increase of London defied adaptation and adjustment. The new comers poured in before London had time to think what she would do with them. From Charing Cross or the Royal Exchange a man must walk five miles before he could breathe country air. We lived in smoked-contaminated air in which trees would not develop to their full size. The Thames was but a muddy receptacle of refuse, the water which we drank was at times very near being dangerous to health, and our sewers poured forth 5,500,000 tons of sewage every week. An immense portion of the working population lived in comfortless houses, not a few of which were miserable dens or squalid cabins unfit for human dwelling places.

Was this monster city still to increase, its dreariness to grow vaster and its smoke ever thicker? It might sound paradoxical, but it was nevertheless true, that while those who had means were perpetually trying to get away from London, those who were destitute were always trying to find their way to it. It should be noted, however, that there was nothing exceptional in the increase of London. The vast increase of great cities was a feature of modern civilization, and was equally to be seen in countries where there was a peasant proprietary and in those where there was a system of great domains. It was found not only in Europe, but in Asia, Africa, and America. The problems which the consideration of these facts brought to mind were very serious. There was first the problem of water supply. Our water in London was meager in quantity, inconveniently supplied, various and doubtful in quality, and exposed to immense risk of pollution. The present house cistern system was a survival of barbarism and ought to be done away with, together with all the abominations of bungling plumbing.

There was next the problem of fire, and we ought to realize that we were behindhand with mechanical appliances for the prevention of this great calamity. Hitherto London had relied on the energy of its fire brigade, its peculiar mode of construction, the prevalent methods of heating, and the general habits of the people, all of which lessened the likelihood of a great conflagration. But a great fire was not impossible, and should it come, our means of dealing with it were ridiculously inadequate, our fire brigade being actually less in numbers than those of Paris, Berlin, New York, and St. Petersburg. Either our friends abroad were foolishly timid, or we were criminally negligent.

Then we had graveyards in scores endangering health, and all our arrangements with respect to interment and for checking contagion were behind our science. Now, he would ask them to consider what our great cities ought to be, and what they would be, if we in this generation and our successors in the next could only be brought in time to know our duty, our urgent necessities, and most imminent dangers. It was little that Parliament could do in the matter. It was a thing for society, for the rich and the poor, for the municipalities, and for the reformers who cried out for them. All the contests between Radicals and Tories were of infinitesimally small importance as compared with the question of the preservation of the lives of the people. In considering the city as it ought to be, the first point that required attention was the death rate. The death rate of London was remarkably low, but it ought to be lower still. One of our greatest sanitary reformers (Sir Spencer Wells) had declared that the death rate of our cities ought to be reduced to something like 12 per 1,000 per annum, which would be a reduction of the present rate by about 10 per 1,000. If the death rate were reduced to 12 per 1,000, it would mean 30,000 lives saved each year in London alone, and this great result might be achieved with the money which was now spent lightly on an African war.

Some ten years of engineering labor would be necessary, and then we might have absolutely wholesome water to drink and plenty of it to wash in, a rational and healthy drainage system, pure milk, air without sulphurous fumes in it, cemeteries wholly away from the living, systematic precautions against contagion, hospitals reconstructed on scientific methods, so that they would no longer be nests of pyæmia, no overcrowding, no ill-ventilated factories, less drink, less brutal treatment of women and children, more civilization, more real charity, more true religion. He knew that the death rate of London was already much lower than that of many large towns, and only half that of some Russian and many Eastern cities, but why should we not go further? Why should we not save annually the 30,000 lives which sanitary reformers told us were still sacrificed to our ignorance, folly, and crime? Before glancing at the steps that ought to be taken to arrive at that result, he might say that there were some things to which he would not consent, even for the sake of the health of the community. He would not, for example, allow policemen to wash people against their will, and he would not let the state take the place of parent. Pure water was our first want. He often thought that but for the conservative powers of *medicatrix natura* we should all be dead men in consequence of the impurity of our water supply. There were two or three ways in which London could be supplied at moderate cost with wholesome water. At first he should prefer to try the plan of drawing it from the chalk in the north and south of London, but he believed that ultimately a vast aqueduct must be built down the center of England from Bala Lake or Ullesswater.

Water, like the roadway, was a public and not a private concern. Air, water, and soil were not manufactures as bread and gas were, and men should be no more charged by a company for their water than be asked to pay toll for walking in Hyde Park. It concerned the health of us all that no family should stint itself in its water supply. The free use of water and roadways ought to be secured by public bodies under public control, deriving the necessary funds out of common rates and taxes. Then some day we should have to see to our rivers. There was no positive reason why the Thames, as it flowed by Westminster Palace, should not be as clear as it was at Hampton Court. Factories must no longer pollute its stream with their refuse. Its southern side ought to be embanked like its northern, and the sewage of the town must no longer be discharged into it. Another matter which must be faced was the great problem of death as affecting the health of the living, and the problem would be solved by the adoption of the system of cremation, which afforded the only safe means of disposing of the thousands of corpses which each year are cast upon our hands. Most of the objections to the system were but the melancholy remnants of a childish superstition. Urn burial was one of the most ancient, most beautiful, and most religious ways of disposing of the dead. It was pure, solemn, and dignified. Cremation destroyed every deleterious germ in a dead body, leaving the harmless ashes for preservation. When it should be adopted as a system, the ashes of the greater dead might rest in solemn, sacred chapels in the very heart of our city, while the funeral urns of the many would be placed in *columbaria* around the cloisters which could be added to our churches.

Another change which must be effected was the reformation of our dwelling system. Some day it would be necessary to rebuild London in accordance with the plan of block dwellings. If the town was built on this tenement plan, as Paris and New York were, an enormous amount of area would be saved. There ought to be detached blocks, five or six stories high, each house containing some twenty or thirty families, with common appliances for cooking, baking, exercise, recreation, etc. Each block should contain some sort of infirmary, a spare room for the treatment of serious disease, and one for the disposal of the dead. The homes of our workers ought, in short, to be constructed on the collective system. He was anxious to have a good general, central government for London, but decentralization and local organization were needed as well. By preparing the ground for such organization, the great reform which divided London into sixty parliamentary boroughs was a step of great improvement.

Mr. Harrison concluded his lecture with the following description of his ideal of London: It must be a city where our noble river will flow so bright and clear that the young people can swim in it with pleasure; where we shall again see the blessed sun and clear blue sky, and the towers and steeples rising aloft in the bright air—a city which at night will be made as light as day with electric lamps, and in whose midst fountains will pour forth water from the hills of Snowden or Helvellyn; a city where noxious refuse will be unknown, and where no deadly exhalations will be pumped into homes; a city where typhus and typhoid and smallpox and fevers will be as rare as the plague and as much a matter of history as the leprosy; a city where the dead shall no longer be a terror to the living, where preventable disease will be a crime chargeable to some one and an opprobrium to the district in which it breaks out; a city where no child shall go untaught because it has no suitable school at hand; a city where no man shall go without recreation, or society, or religion, because there are no libraries or museums near his abode, no galleries of pictures to visit on Sunday, no parks within easy reach, and no free seats in the church which he cares to enter.—*Architect.*

Children's Winter Dress.

There is a tolerably general impression in many quarters that in order to promote the health of children it is advisable to subject them to a "hardening" process. The meaning of this term it is needless to explain further than to say that its aim is to encourage native energy by opposition, to engender strength of mind and body by early participation in the struggle for existence. The principle is in itself a wholesome one, and is not without its parallel in the history of nature's processes. Care is most necessary, however, in its application. Without such care it may be, and frequently has been, overdone. In particular must it be remembered that all success in the adoption of this plan in education depends on the possession by a child thus trained of a basis of sturdy physical vigor. A delicate child, if treated after the same method, would languish and probably succumb. We have been led into this train of observation by noting the frequency with which one finds children of both sexes and of different ages, constitutions, and positions in life treated after one uniform prescription of hardy training. We would now concern ourselves particularly with that aspect of the question which has to do with clothing during such inclement weather as prevails at present. That considerable variation of opinion should obtain among parents with regard to this subject is only to be expected. Here, it may be said with truth, is room for the wise exercise of private judgment, and here we may in many cases find occasion to apply the maxims of the hardening system. So much may safely be granted, but we must not forget that certain essentials cannot be dispensed with under any plan adopted. Among these the maintenance of bodily heat and dryness is all-important, and certain of the most prevalent customs of domestic life incline us to believe that the fact is but slightly understood. The hat, for example, is often, in the case of girls, far too light and too cool. Instead of straw, we would substitute some form of woolen material, just as boys, with few exceptions, are commonly provided with hats of wool or felt, which are at once light, comfortable, and suitably protective against weather. Underclothing is another matter which does not as yet receive adequate attention. We still find the linen shirt or chemise worn very commonly next the skin. This is an error in personal hygiene which cannot under any system be excused. Summer and winter, indeed, present no material difference as regards the choice of an undergarment. Lighter or heavier, the material certainly should vary in accordance with the degree of external cold; but throughout the year no other substance is so wholesome or so preventive of chill as a woolen fabric. Of the feet we need, perhaps, hardly speak. For them, as for the rest of the body, a casing of wool is the prime requisite; and, indeed, the use of this material as a general investment for the skin will be allowed by members of the profession generally to be the great regulating principle in arranging the dress of children, whatever the view most approved in their physical education.—*The Lancet.*

Trade Mark Decision.

The United States Circuit Court for the District of Massachusetts lately held, in the case of Evans vs. Van Laer, that the plaintiff, in the absence of fraud, was not entitled to the exclusive use of the word "Montserrat" as a designation for lime juice, Montserrat being the name of an island from which both parties imported lime juice.

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ENGINEERING INVENTIONS.

A smoke consuming apparatus for steam boilers has been patented by Mr. Alfred Don, of 21 Cooper Street, Redfern, Sydney, New South Wales, Australia. This invention covers a novel apparatus for projecting a jet of combined air and steam into the fire box, making an increased combustion, and to consume and disperse the smoke in the fire box.

A car coupler has been patented by Mr. Louis A. Rudisill, of Charlotte, N. C. It has an armed link-securing wheel, with a bolt movable transversely across the path of the wheel, in combination with a drawhead, spring, and other novel features, making a simple and strong construction, in which it is not necessary to slack up the cars to uncouple.

A central rail fastening has been patented by Mr. Thomas A. Davies, of New York City. Combined with rails united by fish plates are opposing angle plates located centrally of the rails in engagement with the web and base, a fastening device passing through the web and plates, with other novel features, to prevent creeping of the rails, and requiring only a reduced and simple fish plate.

MISCELLANEOUS INVENTIONS.

A lubricant has been patented by Mr. Edward C. Leahy, of Halifax, Nova Scotia, Canada. It consists of cocoanut oil, lard, tallow, plumbago, yarn waste, tin crystals, carbonate of soda, and chloride of sodium, combined in certain specified proportions.

A wagon has been patented by Mr. Edward M. Allen, of Stafford, Md. Combined with front and rear axles and a perch connecting them are body supports pivoted on the axles, novel draught devices, with a particular form of brake construction and connections.

A flying machine has been patented by Mr. William Beeson, of Dillon, Montana Ter. It has a mainsail and a tail or backsail, both supported from a board which ranges fore and aft under the mainsail, with a pendulum bar to which is affixed a support for the aeronaut.

A burglar alarm has been patented by Mr. William H. Reiff, of Philadelphia, Pa. It is a bell rung by a power, a detent for stopping the power mechanism, and pivoted trip which is set in position for engagement by an opening door, the latter causing the trip to fall and permitting the alarm to sound.

A flour bolt has been patented by Mr. John M. Cook, of Baltimore, Md. It is adapted to be run with equal facility in either direction, causing the stock to be delivered upon the cloth on both sides of the axis over an extended area, and is provided with a set of knockers for jarring the cloth and dislodging adhering stock simply and effectively.

A lamp supporting attachment has been patented by Mr. Nelson Guyer, of Lima, Ohio. A post or standard adapted for connection to a table has a tube fitted upon it, with an arm supporting a lamp bracket, and a second arm bracing the first arm and carrying pins and hooks, making a lamp support especially adapted for sewing machines or tables.

The manufacture of gas forms the subject of a patent issued to Mr. William W. Dashiell, of Bergen Point, N. J. Combined with a gas apparatus are heating devices for an air, steam, and oil supply, the oil and steam being each supplied through a single conductor, and equally distributed in a generator over the fire.

A window frame and sash have been patented by Mr. John E. Jones, of New York City. The sash has at its outer edges straight surfaces with inclined rabbets facing the window frame, combined with tapering strips secured to the window frame, making a packed window frame and sash designed more particularly for railway cars.

A spring vehicle has been patented by Messrs. Jonathan G. Huff and Lemuel H. Huff, of East Bend, N. C. This invention refers to light vehicles of the "side bar" description, being intended to relieve them of injurious strains, render them lighter, more durable, and easier riding, and to simplify and cheapen their construction.

A printing machine has been patented by Mr. Charles F. Howe, of Greenleaf, Kansas. It is a platen machine, for doing general newspaper printing, the ink rollers traveling forward and back on a main frame, the paper being carried by endless belts, and the invention covering various novel features of construction and the arrangement of parts.

A button attaching machine has been patented by Mr. Harrison Tone, of Denison, Texas. It is for securing the ordinary four-holed metal button to pants, and has different sizes of dies in combination with a plunger, the dies having a flange and central projection, with parallel oblique curved recesses, a washer being ordinarily used in connection with the button.

A washer cutter has been patented by Mr. Charles Wunderlich, of Washington, Mo. This invention covers a novel construction and arrangement of parts in a device in which the knives are removable for sharpening, and each is vertically adjustable to regulate the depth of cut according to the thickness of leather, rubber, or other material from which the disk or washer is to be cut.

A safety inkstand has been patented by Mr. Louis B. Prahar, of Brooklyn, N. Y. It is an improvement on a former patented invention of the same inventor, there being combined with the outer and inner casings and their covers a circularly bent spring plate between the casings, with arms extending from its upper edge, so that there will be no liability to breakage.

A draft, check, or other money order or instrument forms the subject of a patent issued to Mr. William T. Doremus, of Flatbush, N. Y. It is made with spaces, and provided with numerals and words, whereby the instrument can be filled out in such manner as to prevent it from being raised, the invention being an improvement on a former patented invention of the same inventor.

A vehicle wheel has been patented by Mr. G. L. Herrmann Schneidewind, of Altona, Prussia, Germany. It is of the class known as "cycloid wheels," wherein the weight is distributed at various points on the periphery, so that, when the wheel is traveling backward or forward, its momentum will be increased in the direction of its revolution by the distribution of its weight.

A can cover and clamp has been patented by Messrs. Edmund R. Bristol and Edward C. Gran, of Jordan, Minn. Combined with a can cover having a recess, and a top cross bar held over the cover, is an adjustable screw or pin fitted to the cross bar and entering the recess in the cover when the cross bar is locked, making a simple and inexpensive shipping can or package.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.

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4. Perspective view and floor plans for a Suburban Residence, costing Sixteen Thousand Dollars.
5. Illustrations consisting of plans and perspective, for a corner house to cost about Five Thousand Five Hundred Dollars.
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13. Engravings of the Tavern, the Casino, and Casa Grande, at Decatur, Ala., also a picture of the Anniston Inn, at Anniston, Ala.
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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 24, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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38th ANNUAL STATEMENT
OF THE
ÆTNA
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OF HARTFORD, CONN.
January 1, 1888.

Premium Receipts in 1887, - -	$3,202,098.69
Interest Receipts in 1887, - -	1,640,533.34
Total Receipts during the year, -	4,842,632.03
Disbursements to Policy-holders, and for expenses, taxes, &c., -	3,893,783.65
Assets January 1, 1888, - - -	32,620,676,76
Total Liabilities, - - - - -	27,193,053.36
Surplus by Ct., Mass., and N. Y. standard, - - - - - - -	5,427,623.40
Surplus by many States, - - -	7,319,000.00
Policies in force January 1, 1888, 65,485, insuring, - - -	97,372,334.44
Policies issued in 1887, 7,406, insuring, - - - -	14,380,449.00

MORGAN G. BULKELEY, President.
J. C. WEBSTER, Vice-President.
J. L. ENGLISH, Secretary.
H. W. ST. JOHN, Actuary.
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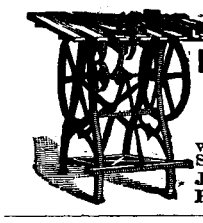
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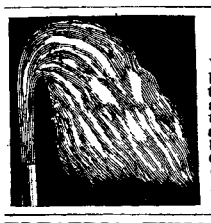
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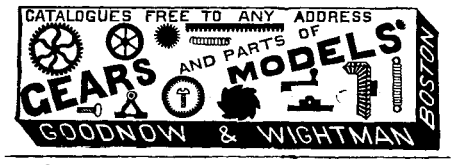

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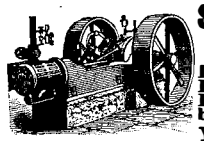
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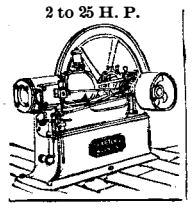

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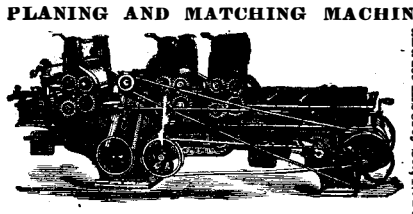

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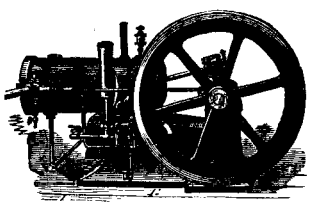

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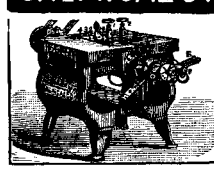

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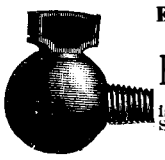

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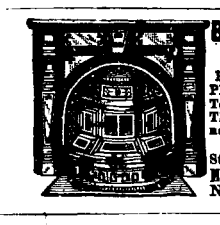

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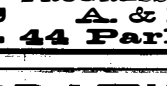

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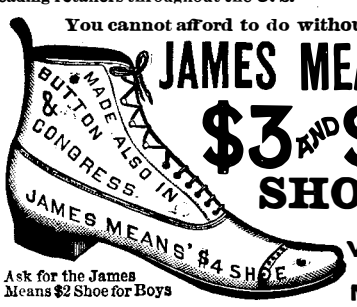

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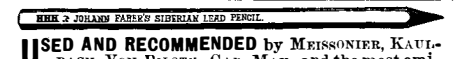

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